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## Original Communications

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### A CONTRIBUTION TO THE BIOMECHANISM AND THE PATHOLOGY OF ECTOPIC PREGNANCY, WITH A CONSIDERATION OF SOME OF ITS CLINICAL PHENOMENA\*

BASED ON A STUDY OF ONE HUNDRED AND THIRTY-ONE CASES

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MEDICAL doctrines are immeasurably influenced by the personality of the promulgator, by the medical milieu of the particular period, and by the means of research extant at the time of their formulation. It is therefore proper that scientific as well as sociologic dicta should be subjected to critical analyses and revisions from time to time, so that they may retain their value as living instruments in our realm of knowledge. Such inquiries need not always result in an overthrow of the older teachings, for they may also serve well if they bring about a clearer understanding of mooted problems, and a scientific agreement on disputed points. The subject of ectopic pregnancy furnishes an adequate illustration of this contention.

The foundation for the knowledge of extrauterine pregnancy was laid by Nelaton in 1861, when he stated for the first time, that pelvic hematocele was not a retroperitoneal hemorrhage of some unknown cause, but the end-result of a ruptured ectopic gestation. Carl Schroeder in 1866, Veit in 1884, and Voisin in 1892, have added important building stones to this chapter in gynecology. Hosts of

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\*Read before the Brooklyn Gynecological Society, and the Section of Obstetrics and Gynecology of the New York Academy of Medicine.

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pathologists and gynecologists have labored in this field since then, yet the voluminous literature on ectopic pregnancy still abounds in contradictions and uncertainties concerning some of its very fundamentals. The storm of controversy rages particularly around the following basic principles: The manner of nidation of the ectopic ovum; the formation of a reflexa; the decidual reaction of the extrauterine connective tissues; the most frequent site of rupture; the terminology defining the end-results of tubal pregnancy; and the manner and method of therapy. The material at my command has furnished me with data which throw light upon many of these mooted problems, and I offer the results of this study for consideration.

# I. A DETAILED STUDY OF SPECIALLY SELECTED CASES, EACH REPRESENTING A DIFFERENT TYPE OF ECTOPIC GESTATION

CASE 1.—*Isthmial Pregnancy with an External and an Internal Rupture.*  
L. G. S., age twenty-six, married six years, nullipara. Menses began at the age

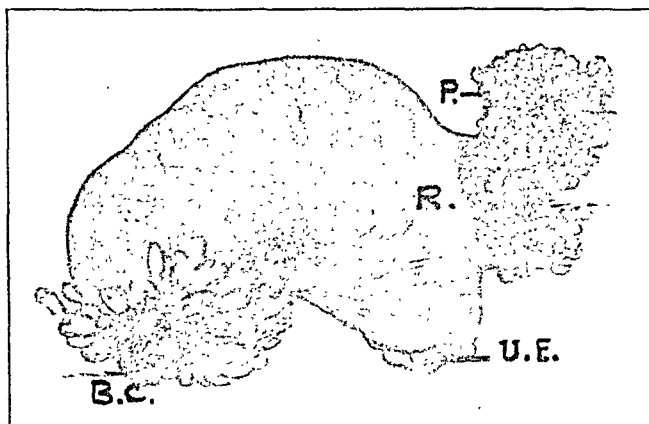


Fig. 1.—The external rupture (*R*) is filled with placental tissue (*P*), the internal rupture is indicated by the blood clot (*B.C.*) protruding from the imbricated end. Uterine end (*U.E.*).

of twelve, twenty-eight-day type, lasting three days, moderate in amount and painless; the last period occurred on Nov. 25, 1920. On Dec. 30, 1920, she was taken ill with general abdominal pains and vaginal bleeding; the pains lasted for an hour, but the vaginal bleeding continued. On Jan. 6, 1921, she had a second attack of abdominal pain, more marked in intensity, and chiefly in the left lower quadrant of the abdomen, and radiating to the left thigh anteriorly. This attack lasted about three hours, followed by a sensation of relief, but a continuation of the vaginal bleeding. Five days later the third attack occurred, similar in character to the previous ones, and in addition nausea and fainting developed. On Jan. 19, her temperature was 100°; respiration, 28; pulse, 108, with moderate vaginal bleeding. The uterus, displaced upwards, forwards and to the right, was not enlarged; the posterior and left fornices were filled with soft doughy-like contents. Pain is elicited on displacing the cervix forwards, and on the release of abdominal pressure. A diagnosis of left tubal pregnancy was made, and a laparotomy was performed soon thereafter, which showed a ruptured isthmial pregnancy, with blood escaping through the tube wall and from the imbricated end. The tube (Fig. 1), irregularly enlarged and distended, bluish gray in color, with a smooth

glistening peritoneal coat, showed, about 1.5 cm. from the uterine end, a rupture in its upper wall, filled with young placental tissue; its edges were bent outwards, and no other rupture point was seen. A blood clot protruded from the fimbriated end. A longitudinal section of the entire tube (Fig. 2) shows that the nidation took place in the upper wall of the isthmus, causing the latter to undergo a marked hyperplasia, with a lymphocytic infiltration and some polynucleosis, but no evidences of acute or productive inflammation. Some of the muscle fibers in this area have undergone hyaline changes. The rest of the tube wall shows marked attenuation due to the intratubal pressure, which has also caused the mucous folds to decrease in number and size. A more detailed study of the nidation site (Fig. 3) illustrates the exact formation of the capsularis and its relation to the tube lumen. A well-formed diverticulum (Figs. 4 and 5) is present in the lower wall

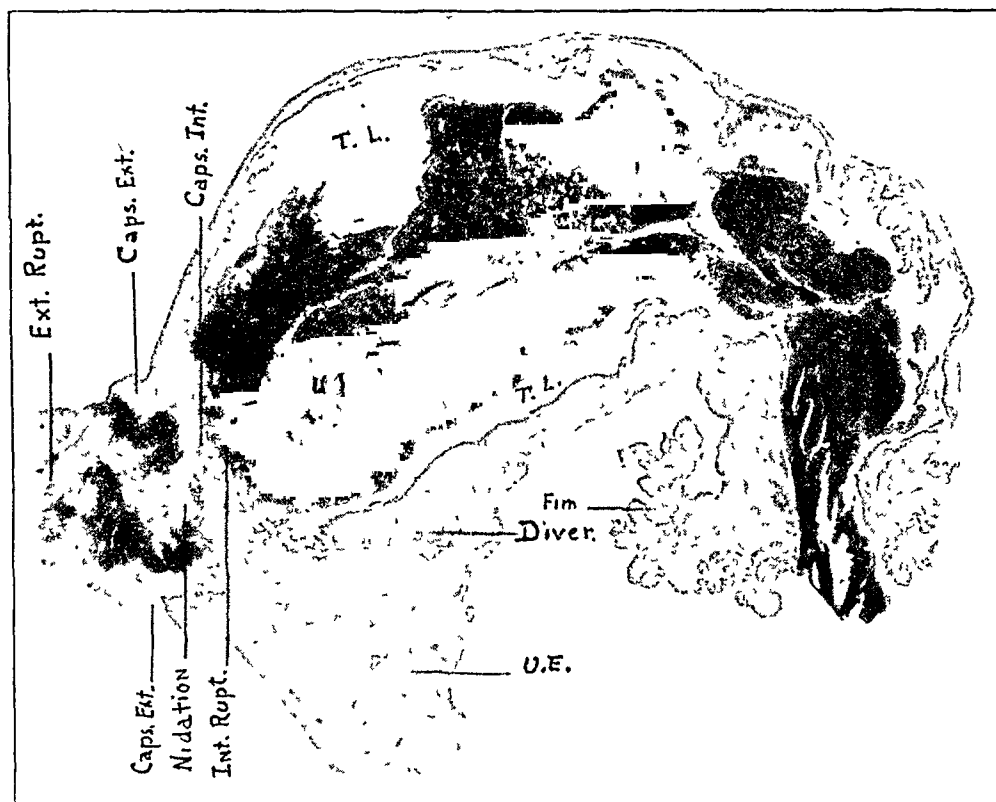


Fig. 2.—Longitudinal section of the entire fallopian tube. The nidation is in the upper wall of the isthmus. The capsularis presents a double rupture; an external (*Ext. Rupt.*) and an internal (*Int. Rupt.*). The tube lumen (*T.L.*) is filled with blood clot, which also protrudes through the fimbriated opening (*Fim.*). The diverticulum (*Diver.*) is located in the inferior wall. (*Caps. Ext.*), capsularis externa; (*U.E.*), uterine end.

of the isthmial portion, just opposite to the nidation site. This diverticulum is invested with its own muscular coats, and is lined with a mucosa identical with that of the rest of the tube. Its lumen is free, its mucosal folds not agglutinated, and it communicates freely with the main lumen. Adenomatous changes (Fig. 6) in the tube wall are found proximally to the gestation area. A well-pronounced decidual reaction is present in the walls of some of the blood vessels (Fig. 7) adjacent to the ovular bed. Under still higher magnification (Fig. 8) the decidual reaction stands out with greater clarity, against the layer of Langhans cells close to it. Epicicis: clinically and pathologically, this case is one of isthmial pregnancy with a double rupture, one leading directly into the abdominal cavity through the capsularis externa, the other into the tube lumen through the

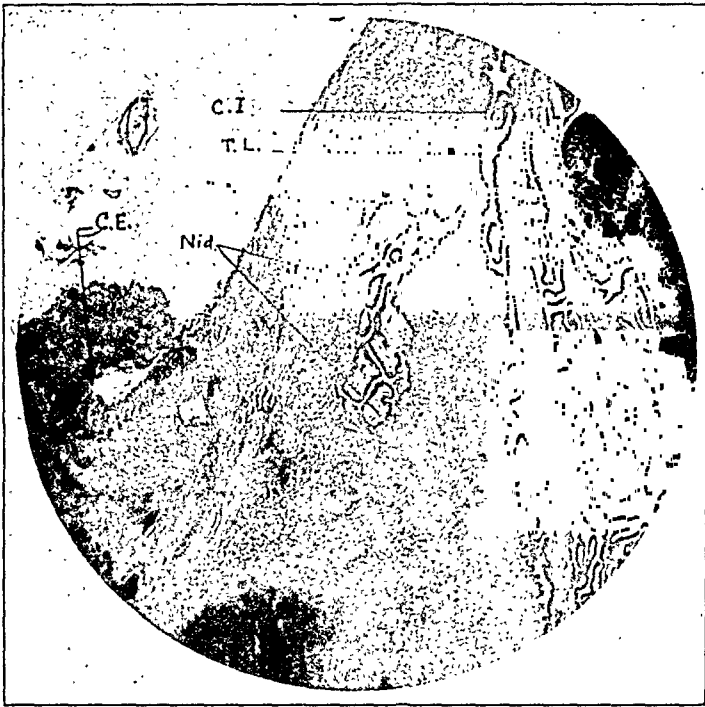


Fig. 3.—The nidation (*Nid.*) within the tube wall caused the latter to spread asunder, thus forming an outer and an inner envelope for the developing ovum. The internal capsule (*C.I.*) bears on its tubal side a covering of tubal mucosa, while the capsularis externa (*C.E.*) has a peritoneal coat. At the point of the outer break in the capsularis the edges of the rent are turned outwards. The tube lumen (*T. L.*) contains blood clot (*B.C.*). (*T.M.F.*), tubal mucosa folds.



Fig. 4.—Tubal diverticulum showing the fundus of diverticulum (*F.D.*), and part of the lumen (*L.D.*). The tube lumen (*T.L.*) is above.

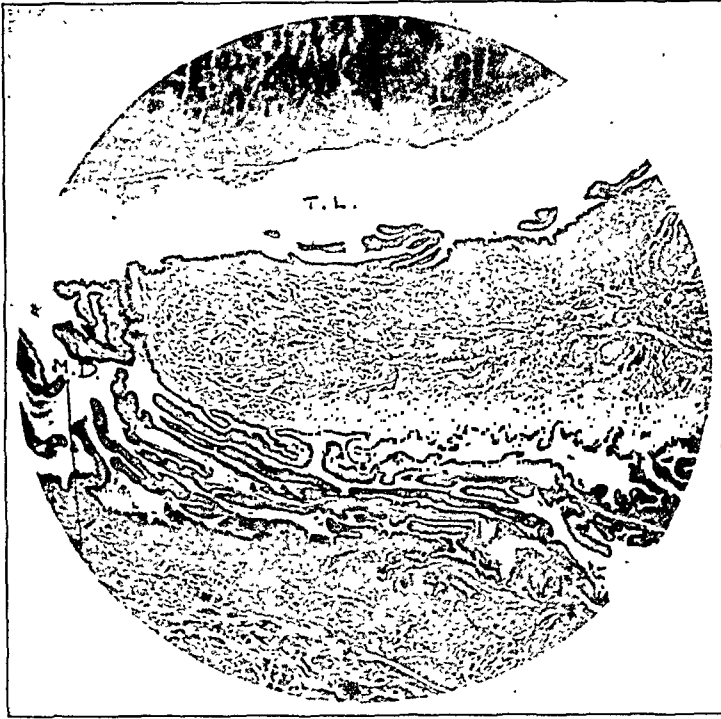


Fig. 5.—Tubal diverticulum, terminal portion. The mouth of diverticulum (*M.D.*) joining the tube lumen (*T.L.*).

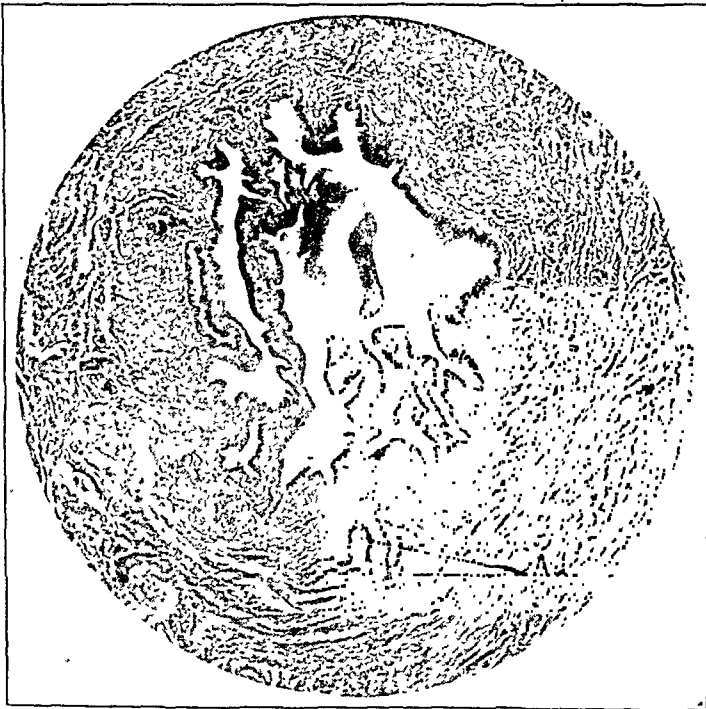


Fig. 6.—Isthmal portion of the tube proximal to point of nidation, showing adenomyomatous changes (*Ad.*) in the wall.

internal capsule, from where the blood gained access to the peritoneal cavity through the fimbriated opening. From the manner in which the edges of the rent in the external capsule are bent it may be inferred that two forces were active in the production of the rupture: (a) a hemodynamic force, resulting from



Fig. 7.—Decidual reaction in a blood vessel wall (*D.B.V.W.*). A layer of Langhans' cells (*L.C.*) stands out in marked contrast to the decidual reaction in the wall of the blood vessel on one side, and to the chorionic villi (*C.V.*) on the other.

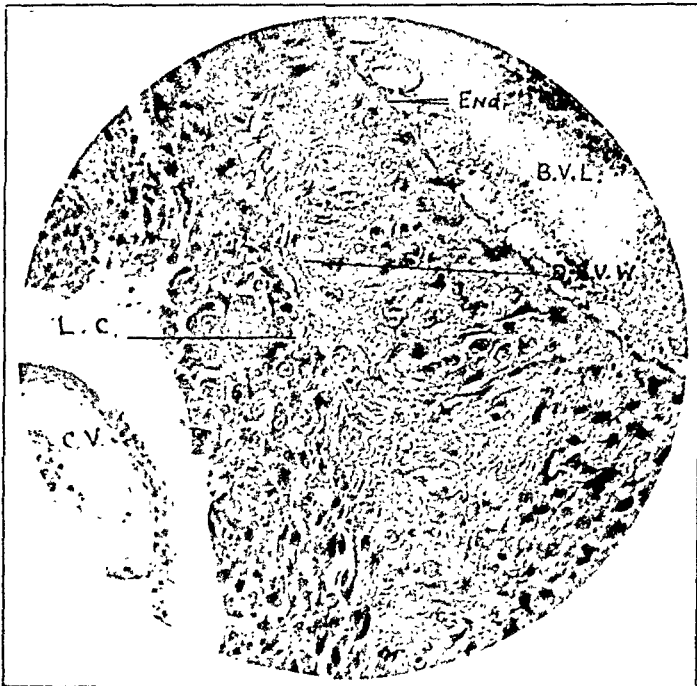


Fig. 8.—A still higher magnification of the decidual reaction in the blood vessel wall (*D.B.V.W.*), showing the blood vessel lumen (*B.V.L.*), the endothelial lining (*End.*), the layer of Langhans' cells (*L.C.*), and part of a chorionic villus (*C.V.*).

the excessive intracapsular hemorrhage, which tore the already weakened and eroded wall, and (b) a myodynamic force, exerted by the intact muscle fibers upon the damaged ones, pulling the latter apart. The internal rupture is proved by the

large quantity of free blood in the tube lumen. The diverticulum in this case I consider as congenital for it is invested with its own muscular coats, thus differing from the endosalpingial invasion of the muscularis as a result of suppurative salpingitis. It is also noteworthy that the diverticulum, although of large size and communicating freely with the main tubal lumen, did not trap the migrating ovum.

CASE 2.—*Isthmial Pregnancy with an Intracapsular Rupture.* E. A., age twenty six, one child, two years and eight months ago; two spontaneous miscarriages, one, three and a half years ago, and the second, eight months ago. Menses began at the age of thirteen, twenty-eight-day type, lasting three days, painless and moderate in amount. The last period occurred on Jan. 21, 1921. On Feb. 3, after bathing, she noticed some vaginal staining, accompanied by pain in the left lower quadrant of the abdomen, which radiated to the left thigh anteriorly. On Feb. 27, the abdominal pain became more intense and the vaginal bleeding more profuse. On the following day she felt a sudden gush of watery fluid from the vagina and the expulsion of a few blood clots (most likely a decidual cast). A physical examination on March 7, 1921, showed a slightly irregular but not enlarged or softened uterus. The right adnexa were palpable and apparently normal. To the left of

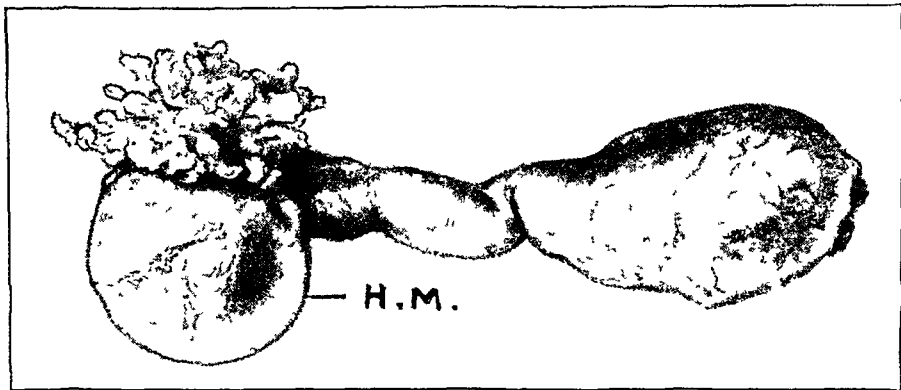


Fig 9.—The superficial blood vessels show congestion, and at the fimbriated end an hydatid of Morgagni (H.M.) is attached.

the uterus and close to it, appeared a fusiform tumor mass, separate and distinct from the ovary, and from another round cystic tumor the size of a walnut, anteriorly. The vaginal fornices were free. Diagnosis: left tubal pregnancy unruptured. Operation, performed April 19, 1921, consisted of a left salpingectomy and appendectomy; no free blood in the peritoneal cavity.

The specimen (Fig. 9) consists of the fallopian tube (viewed from behind), irregular in outline due to a pear-shaped enlargement of its inner half, which is marked off from the nondilated portion by a twist in its long axis. The peritoneal surface is smooth and glistening and the superficial blood vessels congested. An hydatid of Morgagni the size of a walnut is attached to the lower free border of the fimbriated end. A longitudinal section of the entire tube (Fig. 10) shows the pregnancy to be located in the inner half of the tube, which is distended to its outmost capacity. The gestation mass consists of a large blood clot, chorionic villi, fibrin, clumps of syncytium and debris. The lacunar hemorrhage stayed within the capsular confines, distended and pushed it towards the surrounding tube wall, with which it fused into one structure, thus obliterating the landmarks of the reflexa. In or about the center of the gestation mass the embryonic vesicle is seen, consisting of a hyaline homogeneous pinkish staining mass, surrounded by the amnion with its outer chorionic envelop; no traces of the embryo are found. The



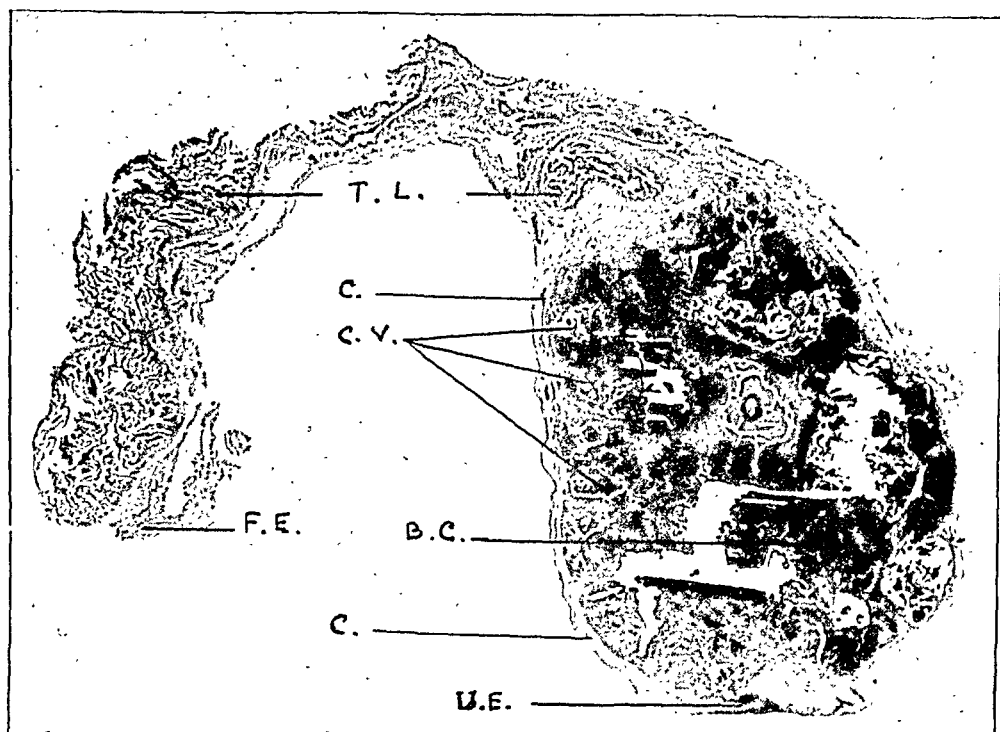


Fig. 10.—Longitudinal section of the entire tube. The gestation mass occupies the isthmal half; it consists of blood clot (*B.C.*); chorionic villi (*C.V.*), the remains of the ovum (*O*), and debris. It is surrounded by the thinned out but intact tube wall, which forms the capsularis (*C.*), so that the hemorrhage remained within its confines. The uterine and the fimbriated ends are seen respectively at (*U.E.*) and (*F.E.*). The tube lumen (*T.L.*) was displaced to one side.

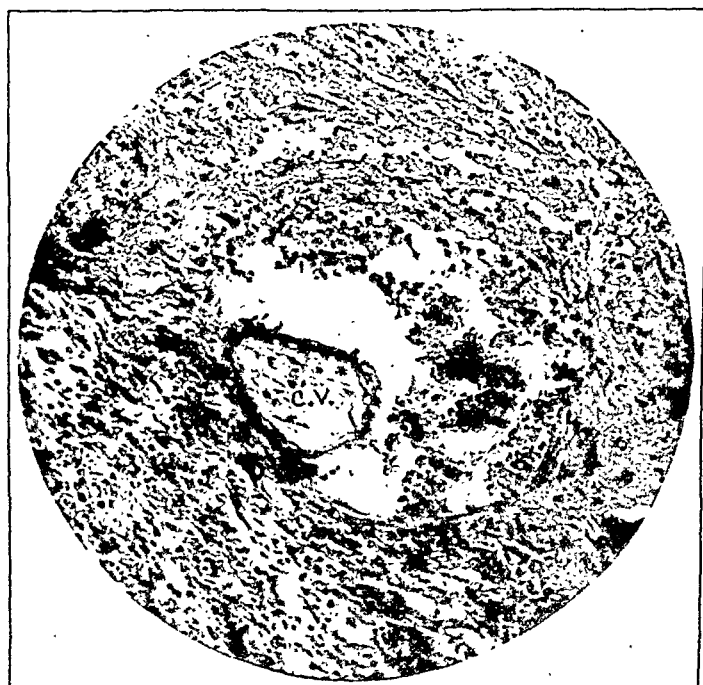


Fig. 11.—Cross-section of a vein containing a chorionic villus (*C.V.*).

tube lumen is pushed over to one side, and it presents a normal appearance. The stasis in the superficial blood vessels is due not only to the pressure by the intra-tubal contents, but also and chiefly to the obstruction of many of the venous channels by trophoblastic masses within their lumina (Fig. 11). *Epicrisis:* This case is one of intracapsular rupture, clinically considered as an unruptured tubal gestation, because no blood escaped either through a rent in the tube wall or through the fimbriated end. It is also of great interest to note the fact that, according to the statement of the patient, no menstrual period was skipped, and the uterine bleeding manifested itself as early as the thirteenth day after the last period. From these data it may be inferred that while the ovular death was signaled by the first appearance of the uterine bleeding, the extensive intracapsular bleeding has continued for some time thereafter, through the posthumous activity of the chorionic villi.

CASE 3.—*Ampullar Pregnancy with Multiple External Ruptures.* I. E., age thirty-nine, married sixteen years, has had three children, the last one thirteen

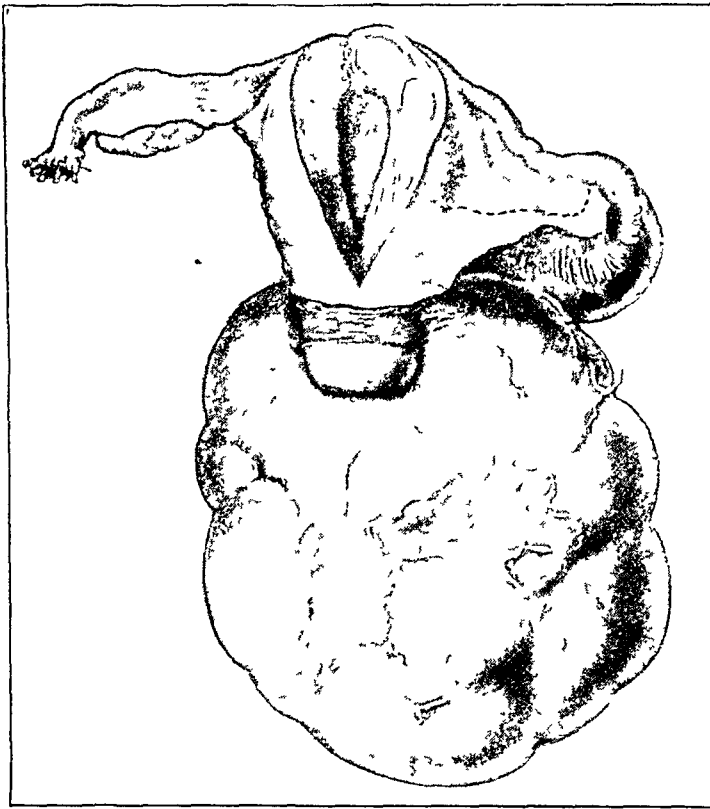


Fig. 12.—Ampullar pregnancy with multiple erosions, and complicated by fibroids of the uterus, interstitial and subserous in type.

years ago, and three induced abortions, the last one eight years ago. Menses began at the age of fourteen, twenty-eight-day type, lasting five to six days, moderate and painless; the last period occurred on April 18, 1921. On June 1, 1921, she noticed some vaginal staining which lasted for a few hours; six days later there was a return of the bleeding for one day. On June 9, at three A.M., sudden sharp pains were felt in the hypogastrium, radiating to the rectum; these pains recurred at irregular intervals with increasing severity, and accompanied by fainting sensations. For the past few days she also complained of dyschesia, and with each attack of pain the vaginal bleeding increased. Physical examination, June

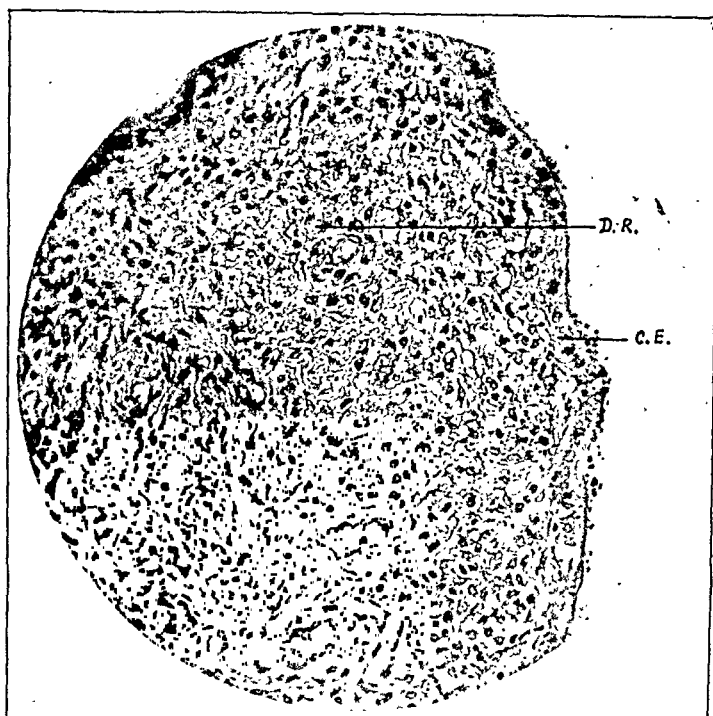


Fig. 13.—The submucosa of the isthmial part of the tube showing a pronounced decidual reaction (*D.R.*). The overlying columnar epithelium (*C.E.*) has a normal appearance.



Fig. 14.—Uterine mucosa in tubal pregnancy, presenting all the hyperplastic changes characteristic of pregnancy, excepting the presence of trophoblastic elements. (*C.*) Compacta; (*S.*) Spongiosa; (*B.*) Basalis; (*M.*) Muscularis.

20, showed abdomen tender to touch over the lower half, and dull on percussion. A vaginal discharge of dark fluid blood was present. The uterus was enlarged to the size of a two months' gestation, irregular in outline due to several interstitial fibroids, and displaced upwards and to the right by a hard pelvic tumor, the size of a grapefruit. To the left of the pelvic tumor was a fluctuating area. Diagnosis: ruptured tubal pregnancy and uterine fibroids. Operation June 20, consisted of an abdominal panhysterectomy and the evacuation of free and clotted blood from the peritoneal cavity. The uterus contained several interstitial fibroids in the fundal portion, and together with its adnexa was perched upon a large infracervical subserous fibromyoma (Fig. 12). The left tube was very much lengthened, distended in its outer half to the thickness of an index finger, purple in color and adherent to the posterior surface of the uterus and the broad ligament. The dilated portion of the left tube harbored a clotted bloody mass containing chorionic villi, fibrin, free trophoblastic islands and débris. The capsularis was made up of the attenuated tube wall, whose musculature was reduced to but a few isolated fibers, the mucous folds hardly recognizable, and the serous coat riddled with many perforations and erosions. No reflexa could be identified, nor could any decidual reaction be noted within or immediately near the gestation area, but in the submucosa of the isthmal portion a pronounced decidual reaction was present (Fig. 13). The uterine mucosa (Fig. 14) presents the characteristic morphology of a decidua of pregnancy. Epicrisis: This case represents an ampullar pregnancy, in an adherent tube with multiple external ruptures, many of which were closed by chorionic villi. This is the reason that the internal bleeding in these types of pregnancy is insidious and why they are operated upon much later than the acute forms. Due also to the late date of the operative procedure, the finer anatomic structures of early pregnancy are no longer discernible.

CASE 4.—*Ampullar Pregnancy with Interno-External Rupture.* A. J., age thirty-three, married sixteen years, one child fifteen years ago, and one induced abortion eight years ago. Was operated upon for a right-sided tubal pregnancy four years ago. Menses began at the age of thirteen, twenty-eight-day type, lasting two days, scanty and painful; the last period occurred July 17, 1918. After an amenorrhea of six weeks, the patient was seized with sharp cramp-like pains in the lower abdomen accompanied by vaginal bleeding. The family physician considered the condition as an incomplete abortion and curetted. As this procedure did not alleviate her pains or stop the bleeding a consultation was requested. My examination on Sept. 2, 1918, revealed a pale looking woman with an irregular pulse varying in frequency from 96 to 110, respiration 28, and temperature 104° F. To the left and posterior to the uterus a fixed fluctuating mass was found. A diagnosis of a ruptured tubal pregnancy was made and an immediate operation performed, consisting of a left salpingo-oophorectomy and removal of the blood clots from the pelvis. No drainage was employed, and the recovery was uneventful. The fallopian tube was dark red and irregular in outline due to two bulbous enlargements, each about the size of a plum. The peritoneal surface was rough, and there were two perforations, one 2 cm. from the fimbriated end, and another one about the middle of the tube. A blood clot was also protruding from the fimbriated end. The isthmal portion (Fig. 15) presents throughout its entire length a double lumen, up to the gestation site, each of which has its individual layers of muscle, but only one serous and subserous coat envelops both of them. The mucosa in both lumina showed unmistakable evidences of a chronic salpingitis (Fig. 16), yet the columnar epithelium was well retained, and in many places also the ciliary covering. A moderate quantity of free blood was present in the tubal lumen. The submucosa showed a mild infiltration with round cells and a moderate decidual reaction. Some of the sections



Fig. 15.—The isthmial portion of the tube presenting a double lumen, each surrounded by a definite internal circular and an outer longitudinal muscle layer, but with a single serous and subserous envelope.



Fig. 16.—A high power study of the isthmial portion of the tube, showing a well advanced chronic inflammation, a mild decidual reaction in the submucosa, no agglutination of the mucous folds, a retention of the columnar epithelium and in many parts also of the ciliated covering. A moderate quantity of free blood present in the tube lumen.

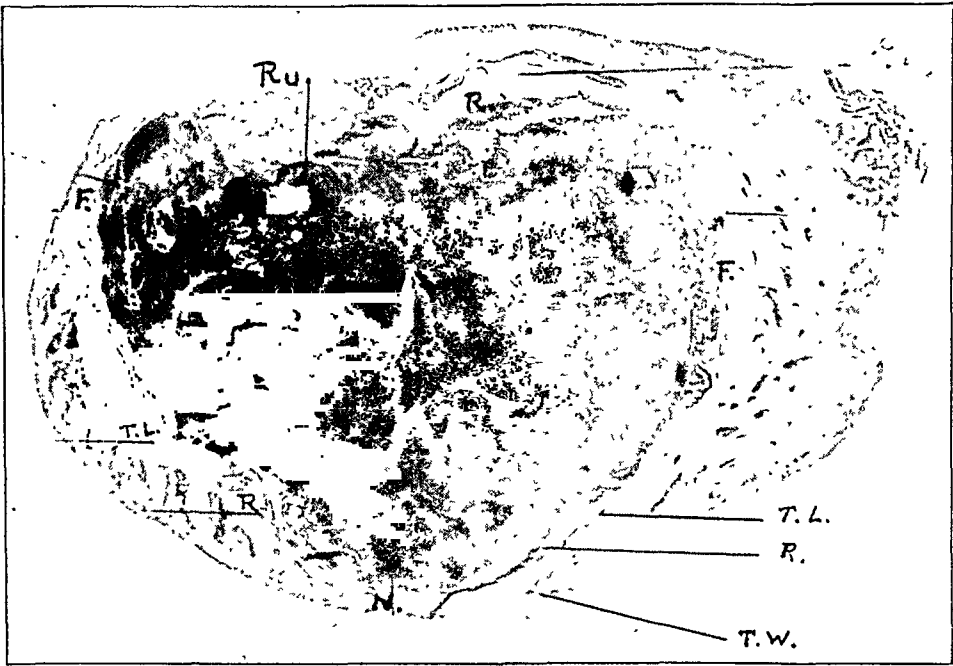


Fig 17.—The nidation (*N*) is mucosal in type. The reflexa (*R*) surrounds the gestation mass which developed centripetally. At a point directly opposite the placentation area, fusion (*F*) between the reflexa and the tube wall occurred and at this point the rupture (*Ru.*) took place. The tube wall (*T.W.*) at the site of nidation has not been invaded by the trophoblast, and the tube lumen (*T.L.*) is seen to either side of the reflexa.

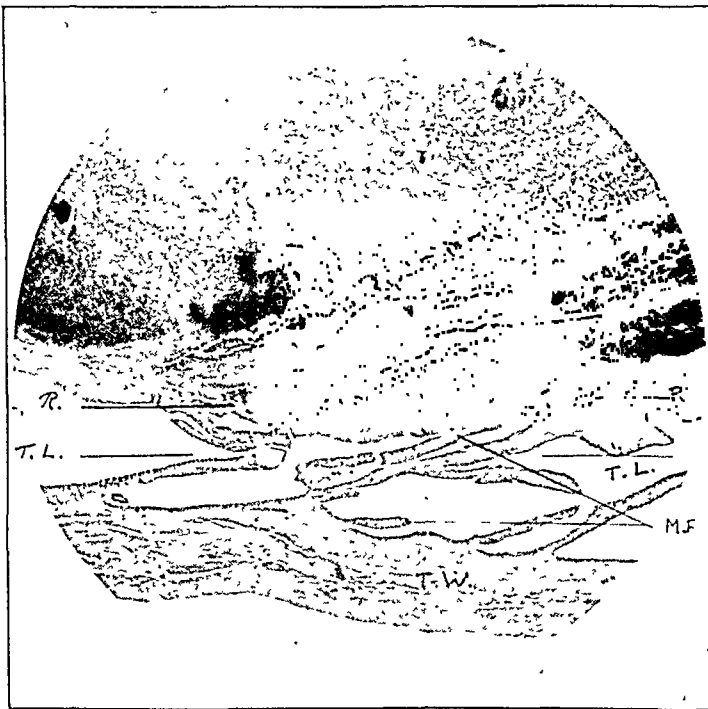


Fig. 18.—A more detailed study of the mucosal type of nidation. The beginning of the reflexa (*R*) is seen to either side of the ovular attachment, the latter resting upon the mucous folds (*M.F.*). The tube lumen (*T.L.*) is free, and the tube wall (*T.W.*) while thickened, is not encroached upon by any products of gestation. *T.W.*, tube wall.

also showed adenomatous proliferation. The nidation (Fig. 17) is mucosal in type, the latter forming a distinct reflexa which fused with the opposite wall of the tube. The rupture took place at the point of fusion. The tube wall directly under the

placentation site (Fig. 18) showed a marked hyperplasia, a round-cell infiltration, an engorgement of its blood vessels, but no trophoblastic invasion. Epicrisis: In this case we find biomechanical factors identical with those seen in intrauterine gestation; namely, a mucosal nidation, and a distinct reflexa. Contrary to the prevalent teaching, the rupture took place at a point opposite the placentation site; this observation is not at all uncommon in my experience. The type of rupture is an interno-external form. By this I mean that the internal capsule had to be eroded before the outer wall of the tube, through which the break has finally occurred. Evidences of chronic inflammation were present in the submucosa of the isthmal portion, while in the ampullar part which harbored the pregnancy they were lacking. Furthermore, the columnar epithelium and its ciliary covering were well retained throughout the greater portion of the tube. It is therefore possible to state with positiveness that in this case at least, neither mucosal folds, nor the want of cilia were responsible for the extrauterine nidation of the ovum. Whether the double tube seen in the proximal portion is a congenital condition or an artifact occasionally encountered in sections of chronic salpingitis, is a debatable question. While I am inclined to an inflammatory genesis, the uniformity and singleness of the serous coat, and the separate muscular coats of each lumen speak in favor of a congenital derivation. Cases of double tubes have been described by Keppler, Schantz and others, some of these authorities attempted to explain the absence of the double lumen in the ampullar portion, as seen in my case, on the basis of a post-natal involution. It requires an unusual stretch of the imagination to fit this theory into the framework of embryologic reasoning.

CASE 5.—*Ampullar Pregnancy with an Interno-External Rupture.* C. K., age twenty-three, married two years, nullipara. Menses began at the age of thirteen, twenty-eight-day type, lasting three to four days, normal in amount and painless; the last period occurred on Feb. 2, 1924. On March 17, she began to spot, one week later she felt a sharp sticking pain in the lower quadrant of the abdomen which radiated to the rectum. These symptoms lasted for one day. On April 1, 1924, she was admitted to the hospital complaining of pain in the lower abdomen, and the left shoulder, and of a fainting sensation. Physical examination showed a tense lower abdomen, dull to percussion and tender on the release of pressure. The cervix, somewhat softened, pointed to the left and the uterus was displaced upwards and to the right. The posterior and both lateral fornices were full. Blood count: R. B. C. 2,750,000; W. B. C. 13,000; polys., 84 per cent; lymph., 16 per cent. Diagnosis: ruptured tubal pregnancy. Operation performed soon after admission consisted of a right salpingectomy, appendectomy, and the evacuation of the free blood from the peritoneal cavity. The right fallopian tube (Fig. 19), irregularly enlarged in its outer two-thirds, was bent upon itself in an inward and downward direction. The distended, ampullar portion was bluish in color and measured 3.75 cm. at its widest diameter. The peritoneal coat was smooth and glistening, and at a point 1 cm. from the fimbriated end, the continuity of the tube wall was broken. This rent was filled with young placental tissue; the fimbriated end was patent and its lumen was free. The isthmal uninvolved portion was normal and its lumen empty. The nidation was in the inferior wall (Fig. 20) and as the pregnancy developed in an inward direction, it displaced the tube lumen to one side. Due to this form of ovular growth the internal capsule was gradually raised, thus forming a true reflexa and with the still further development of the pregnancy, the reflexa was finally brought into intimate contact with the opposite wall of the tube with which it fused. The rupture took place at this point of fusion. Besides the main rupture, smaller eroded but closed areas were present in the tube wall at the site of placentation, one of these is reproduced more minutely in Fig. 21. A detailed

study of the reflexa (Fig. 22) shows that it is composed of the following structures: The central massive part is chiefly muscular derived from that part of the tube wall which lay above the ovum, it is infiltrated with round cells, some of

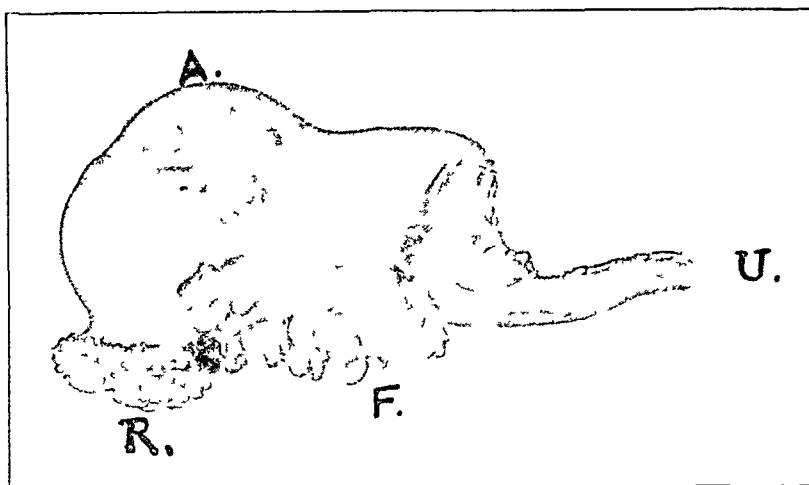


Fig. 19.—Ampullar pregnancy with an interno-external rupture, and a closed arteriosion. Uterine end (*U*), fimbriated end (*F*), rupture (*R*), and arteriosion (*A*), which is closed.



Fig. 20.—Cross-section through the ruptured area. The nidation is intramural and the development of the ovum progressed centripetally, thus forming a reflexa of the inner part of the tube wall (*R*). The rupture (*Ru.*) took place through the internal capsule and the opposite tube wall (*T.W.*) simultaneously. The tube lumen (*T.L.*) is seen displaced to one side. At (*A*) an arteriosion is seen which is plugged with chorionic villi.

the fibers show hyaline changes due to the lytic action of the trophoblast, and some edema. The intermuscular connective tissue shows a decidual reaction, and it is most pronounced in the walls of some of the blood vessels. On the fetal surface



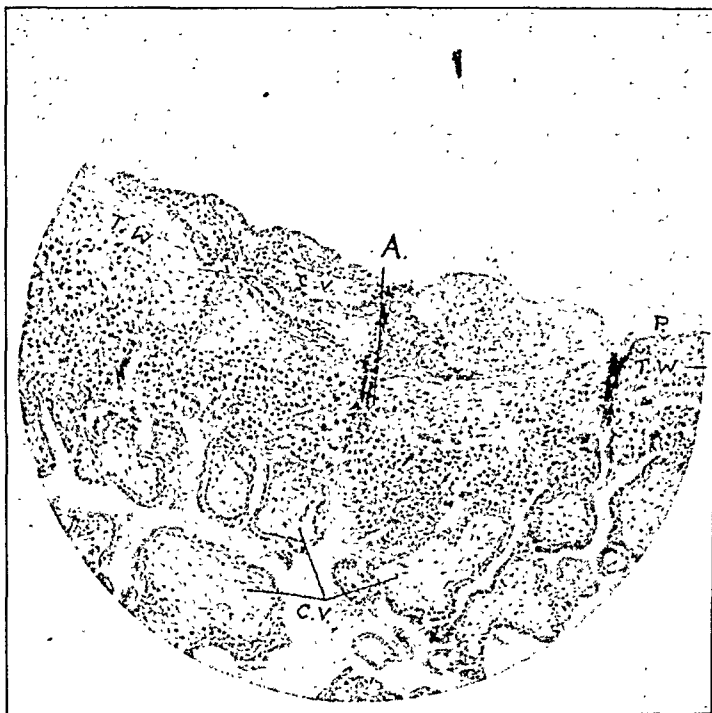


Fig. 21.—A high power study of an arrosion (A) which is closed with the products of gestation. The tube wall (T.W.) is invaded with Langhans' cells and syncytium, and its peritoneal coat (P) is seen on the left. (C.V.) chorionic villi.

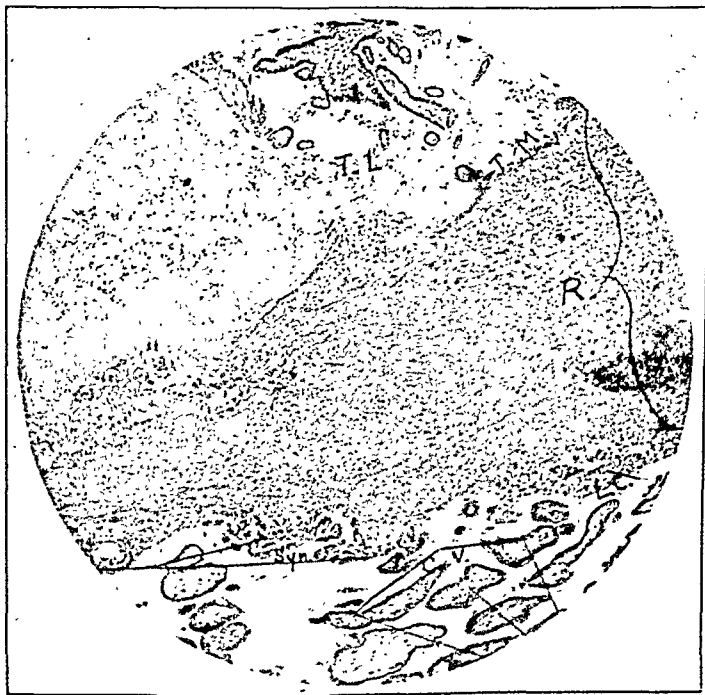


Fig. 22.—The reflexa (R) in more magnified view. The tube lumen (T.L.) contains some debris and old blood. On the fetal side the reflexa is in contact with Langhans' cells (L.C.), chorionic villi (C.V.), and masses of syncytium (Syn.), and on the maternal side it is covered with tubal mucosa (T.M.).

the reflexa is covered with a layer of fibrin, and products of gestation, and on the maternal side with the tubal mucosa. The placental site (Fig. 23) is denoted by the securer anchorage of the chorionic villi, the pronounced hyperplasia of the

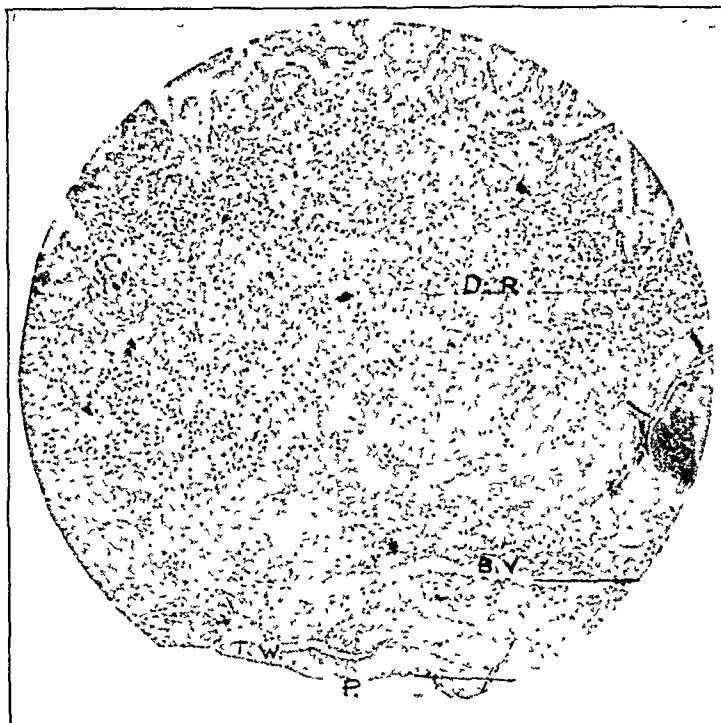


Fig. 23.—The nidation area highly magnified. It shows the hyperplasia of the tube wall (*T.W.*), with a pronounced decidual reaction (*D.R.*), the latter extending also to the walls of the blood vessels (*B.V.*). The peritoneal coat (*P*) is normal.



Fig. 24.—The isthmal nongravid part of the fallopian tube, presenting a very pronounced decidual reaction (*D.R.*) in the subserosa. The serous (*S*) covering is normal.

tube wall, the very marked decidual reaction and by the anatomic origin of the reflexa to either side of the ovular bed. Besides the decidual reaction within and adjacent to the gestation area, more remotely lying connective tissue elements

have also responded proliferatively to the hormones of pregnancy; such a response is found in the subserosa of the isthmal portion (Fig. 24). Epierisis: The type of rupture in this instance is interno-external, shown by the absolute freedom of the tube lumen from any blood or gestation elements, and by the erosion of the capsularis interna and then of the overlying tube wall. Here again the rupture occurred opposite the placental attachment. The only suggestion of a previous salpingitis is the network formation of the mucosal folds seen in the uninvolved portion of the tube. This assumption was strengthened later on through a subsequent inflation test of the remaining tube, which proved to be closed.

CASES 6 AND 7.—*Successive Tubal Pregnancies with Internal Ruptures.* B. P., married two and a half years, nullipara; miscarried once seven months ago in the eighth week of pregnancy. Menses began at the age of fourteen, thirty-day type, lasting three to five days, painless and moderate in amount; the last period occurred

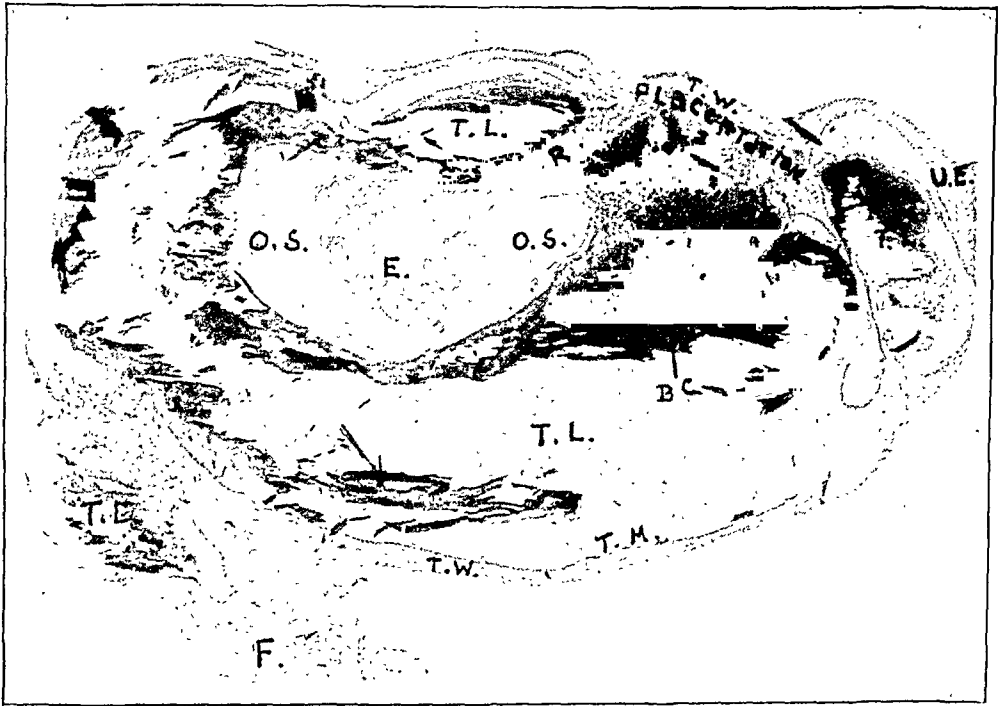


Fig. 25.—Longitudinal section of the left gravid tube. The placentation is in the upper wall of the isthmal portion. The gestation consisting of the embryo (E.) surrounded by the ovular sac (O.S.), and the overlying tubal mucosa and part of the tube wall, which formed respectively a reflexa (R) and a capsularis has developed in an inward direction. The outer layers of the capsularis are broken and the escaping blood from the lacunar spaces fills the tube lumen (T.L.) from the uterine (U.E.) to the fimbriated (F) end. At the area of placentation the tube wall (T.W.) showed thickening while in the rest of its extent, thinning. Blood clot (B.C.). Tubal mucosa (T.M.).

Feb. 14, 1921. On March 22, sudden pain in the left lower quadrant of the abdomen, cutting in character, followed soon by vaginal bleeding. On March 27, two fainting spells, and on April 5, another one. Physical examination on April 10, showed a pale looking woman of normal stature and development, the lower abdomen tender to touch particularly on the release of pressure. Vaginally—dark fluid blood escaped freely, the uterus was dextroverted, tender to manipulation, globular in outline, and not enlarged. A sensitive elongated tumor mass the width of two fingers occupied the left fornix, and part of the culdesac of Douglas. Diagnosis: ruptured tubal pregnancy. An immediate operation was performed; the left tube removed and the peritoneal blood evacuated. The left fallopian tube was irregularly enlarged into a

conical bluish tumor, the widest diameter at the outer end; the abdominal ostium was filled with blood clot. The peritoneal coat was smooth, no adhesions, and the superficial blood vessels markedly congested. The dilated portion of the tube contained an embryo (Fig. 25) 65 mm. in length, surrounded by the ovular sac, and the nidation was in the upper wall of the isthmic portion at a point 1 cm. from the uterine end. The embryo developed towards the tube lumen and the rupture occurred in the internal capsule opposite the nidation area. The tubal mucosa was normal, the lumen to either side of the gestation site patent and contained blood. A distinct reflexa (Fig. 26) surrounded the gestation mass, composed of muscle fibers, infiltrated with round cells, and the interstitial connective tissue showed a decidual reaction. On the fetal side the reflexa was covered with fibrin and trophoblastic elements, and on the maternal surface with tubal mucosa. On Dec. 7, 1924, this same patient telephoned to me that she was again ill with a tubal pregnancy.

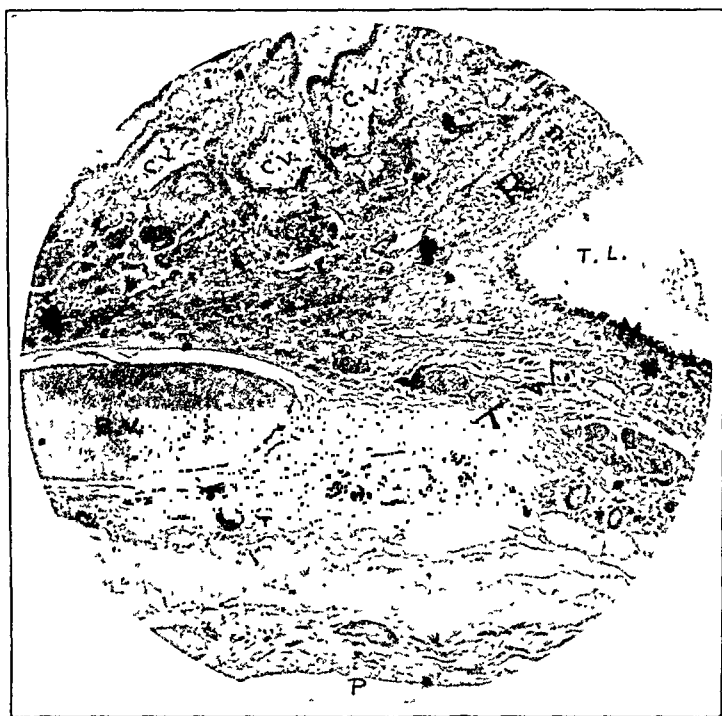


Fig. 26.—High power microphotograph of part of the nidation area, showing the hyperplasia of the tube wall (T.W.), with the marked engorgement of its blood vessels (B.V.). The reflexa (R.) consists of the inner portion of the tube wall which was lifted up by the growing gestation mass, which lies outside the tube lumen (T.L.); the decidual reaction (D.R.) within the reflexa is very pronounced; (M.) mucosa of tube; (P.) peritoneal surface; (C.V.) chorionic villi.

I ordered her to the hospital at once, and on admission she gave the following history: Since her operation in 1921, her menses continued regularly, the last period occurred on Oct. 22, 1924. On Dec. 3, she began to stain; this lasted for a few hours only. Two days later sudden severe pains in the right iliac fossa, and fainting. A physical examination corroborated the patient's diagnosis of a right sided tubal pregnancy. A laparotomy was performed soon after the examination and the right tube removed. It measured 5 by 1 cm., was irregularly enlarged into two nodular swellings, color was dark blue, and the peritoneal surface smooth, glistening, and intact. Blood clot protruded from both ends of the tube. On cross section (Fig. 27) the nidation showed an intramural character involving the isthmic portion. The ovular development progressed towards the tube lumen, thus evolving a well-formed reflexa. The rupture took place in the internal capsule with the blood

from the lacunar spaces escaping into the tube lumen. Besides the chorionic villi, the masses of trophoblast, the fibrin, and the blood, constituting the *gestation mass*, and part of the amniotic cavity were also present. The tube wall was thickened throughout its entire course and in the ampullary part presented adenomyomatous formations. *Epiërisis*: The macroscopic or clinical diagnosis usually made in such instances is one of tubal abortion, since the fimbriated opening was the only avenue through which the gestation products found their way to the peritoneal cavity. The microscopic investigation, however, proved that we were dealing with a rupture of the internal capsule in both instances. It is also worthy of notice, that each time the rupture was opposite to the placental site. Marked decidual reaction within the gestation area was also present in each specimen.



Fig. 27.—Cross-section of the isthmial portion of the right gravid tube. The gestation is intramural in character involving the inferior tube wall (T.W.) which shows a marked thickening throughout its entire circumference. The inner part of the tube wall forms the capsularis (C), and the mucosa, the reflexa (Re.). The rupture (R) point is in the internal capsule through which gestation products gained access into the main lumen of the tube (T.L.).

CASE 8.—*Interstitial Pregnancy with Intracapsular Rupture*. A. H., aged thirty-eight, married fifteen years, para i fourteen years ago, one miscarriage twelve years ago, remained sterile since then. Menses began at the age of seventeen, twenty-eight-day type, four days' duration, moderate in amount and painful, the last period occurred Oct. 20, 1924. Early in December she began to feel nauseated; one week thereafter she was taken ill with intermittent cramp-like pains in the lower abdomen and in the back. A physical examination on Dec. 28, revealed the following facts: General condition good, vaginal mucosa of a purplish hue, no bleeding, the cervix displaced and pressed upwards against the symphysis pubis. The uterus

was dislodged upwards and backwards to the left, by a hard nodular tumor in the hollow of the sacrum. The uterine adnexa were not palpable. A diagnosis of intrauterine gestation complicated by fibroids was made. On Dec. 31, 1924, I performed a laparotomy and found the following conditions: The body of the uterus slightly enlarged was rotated on its long axis to an angle of  $90^{\circ}$  from left to right, and perched upon a hard nodular tumor which occupied the posterior pelvic fossa. It proved to be a pedunculated subserous fibromyoma, the size of a large adult fist, springing from the upper and anterior surfaces of the body of the uterus. The adnexa were normal in appearance. A panhysterectomy was performed, there was no free blood in the peritoneal cavity. The specimen (Fig. 28) included a subserous fibromyoma projecting from the anterior surface of the fundus. The right uterine

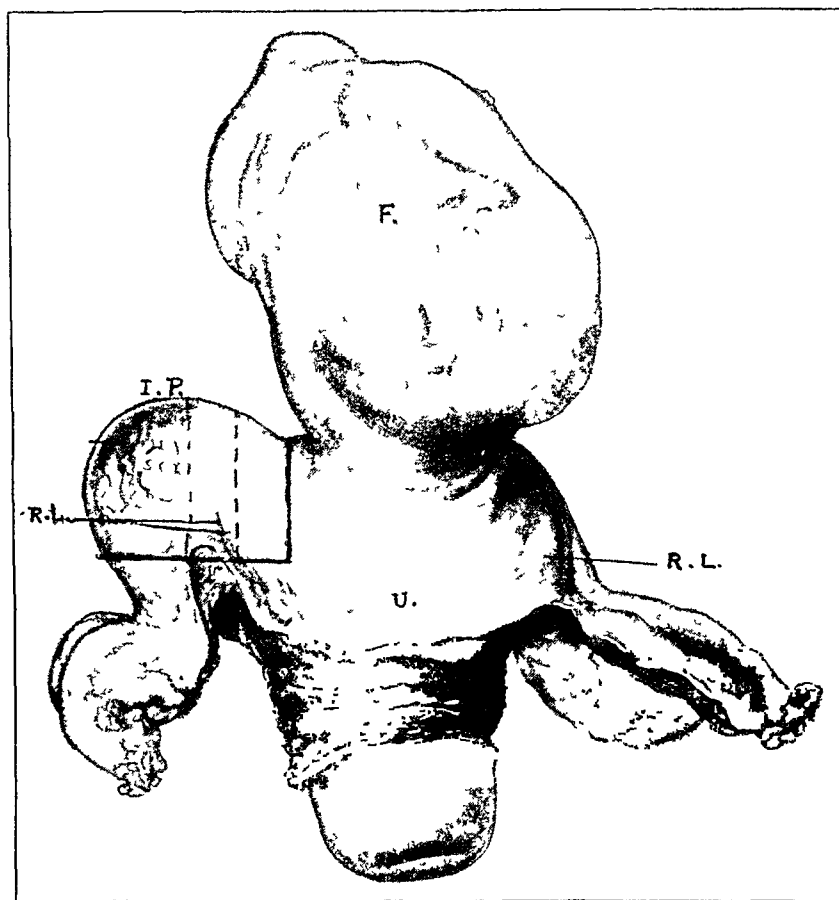


Fig. 28.—Right interstitial pregnancy (I.P.) with an intracapsular rupture. Note the origin of the round ligaments (R.L.), the one on the right is below, in front, and to the inner side of the gestation mass. The fibroid (F) springs from the anterior surface of the fundus uteri (U).

cornu presented a globular smooth swelling, which was of a softer consistency than the rest of the uterus, and with marked engorgement of its superficial blood vessels. The origin of the round ligament on the right side was on the same level as the one on the left, and lay in front, below, and proximally to this mass. The part of the specimen indicated by the heavy lines in Fig. 28 was resected hardened and cut, in an anteroposterior direction into numerous sections, the findings were as follows: The interior of the tumor was hollow, the inner surface of this cavity was wavy, glistening, and grayish in color, covered by a fine membrane composed of the chorion and the amnion. No traces of the embryo were found, apparently lost in the process of fixation. The capsularis contained a moderate amount of blood, the chorionic

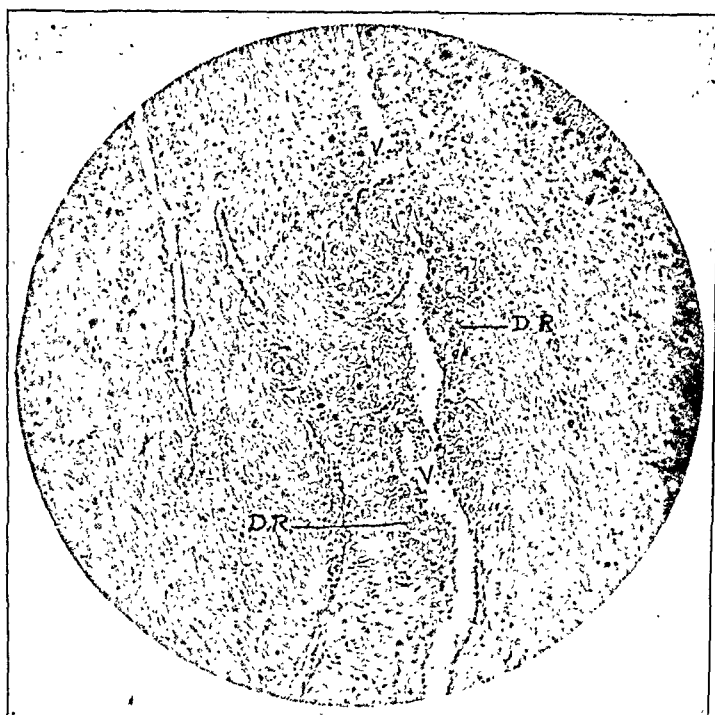


Fig. 29.—Longitudinal section of a vein (V), with a marked decidual reaction (D.R.) in its walls.



Fig. 30.—Blood vessels containing chorionic villi (C.V.), syncytium (S), Langhans' cells (L), and a decidual reaction (D) in its wall.

villi presented a normal appearance and merged imperceptibly and irregularly into the surrounding uterine musculature. The adjacent muscle fibers were split up by the invading chorionic villi into irregular strands and spaces, and many of them showed hyaline changes. The intermuscular connective tissue of this area showed a

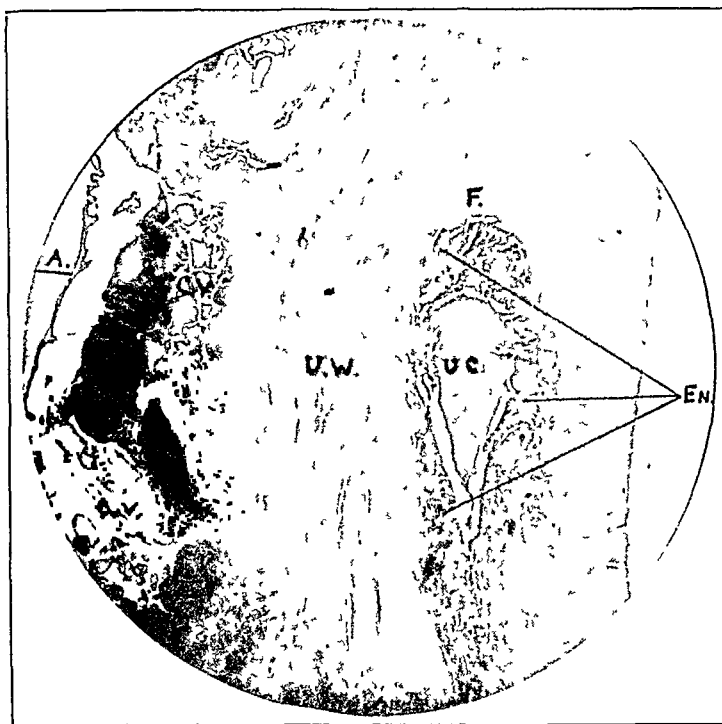


Fig. 31.—Section through the interstitial pregnancy on the right, showing the amniotic cavity at (A.), with its surrounding chorionic villi (C.V.), imbedded in the uterine wall (U.W.). The uterine cavity (U.C.) is to the left, lined with a thickened endometrium, (En.) which extends from the fundus (F) down to the internal os.

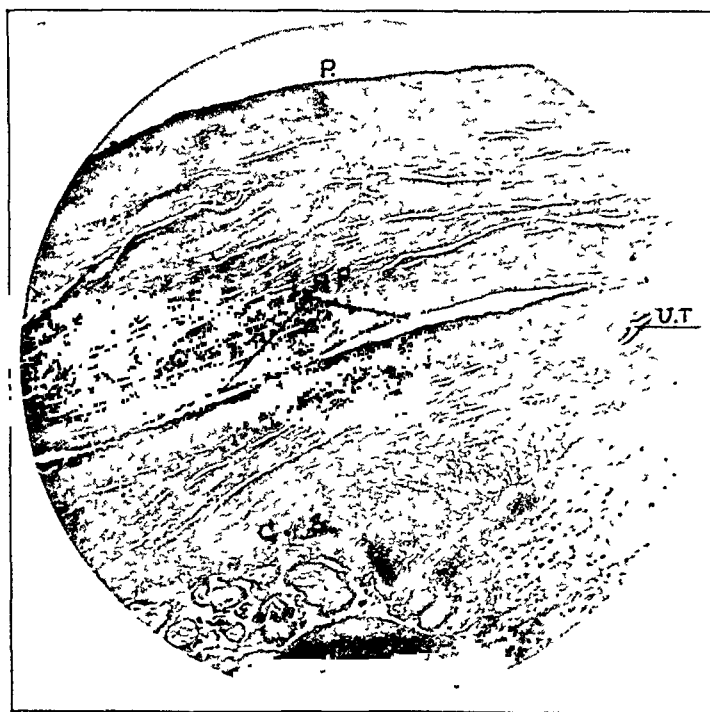


Fig. 32.—Section of the interstitial pregnancy showing the gestation site (G.S.) below, deeply imbedded in the uterine wall; the interstitial part of the fallopian tube (I.P.F.) running longitudinally in an inward and upward direction, to its uterine termination (U.T.), which is characterized by the triangular outline of its lumen, and by the circular arrangement of the muscle fibers around it. The peritoneal covering (P) is normal.



pronounced decidual reaction, which was also accentuated in the walls of some veins (Fig. 29), directly under the endothelial lining. Some blood vessels were filled almost to capacity with trophoblastic material (Fig. 30). The uterine cavity (Fig. 31) was lined with an endometrium characteristic of intrauterine pregnancy, it only lacked the trophoblastic constituents. The interstitial gestation bears no anatomic relation to the uterine cavity or to the tube lumen, as seen in Fig. 32, the latter lay above and to the inner side of the ovular bed. The very terminal portion of the fallopian tube was indicated by the triangular outline of the lumen, which was surrounded by a number of concentrically arranged muscle fibers. No evidences of a chronic salpingitis were found. Epierisis: The absence of any anatomic relationship between the uterine cavity and the ectopic bed proved conclusively its true interstitial character. Further supportive evidence was the anatomic relation which the round ligament bore to the seat of the pregnancy. The reason the gestation area appeared completely outside the tube lumen, giving the impression that the tube was never its seat, was most probably due to the thinness and narrowness of the wall of

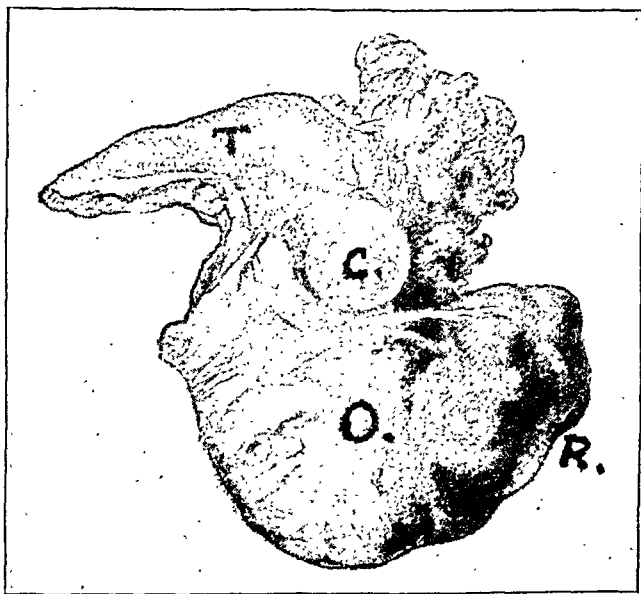


Fig. 33.—Primary ovarian pregnancy. The fallopian tube (*T*) is normal, excepting for the small mesenteric cyst (*C*) near its fimbriated end. The ovary (*O*) is enlarged, its outer half is suffused with blood, and at point (*R*) the rupture took place.

the interstitial part, through which the burrowing ovum passed readily and lost its anatomic connection with it. The absence of uterine bleeding and the nausea which persisted up to the time of operation and the very moderate intervillous bleeding, indicated that the ovum was still alive, at that time. The pain in this case was due mainly to the uterine twist caused by the pedunculated subserous fibroid.

CASE 9.—*Primary Ovarian Pregnancy, Ruptured.* R. K., age twenty-seven, married six and a half years, has had one premature birth at six and a half months, five years ago; one full-term terminated by cesarean section four years ago; and one induced abortion two years ago. Menses began at fourteen years, twenty-eight-day type, lasting five days, profuse and painful, the last period occurred on Sept. 18, 1922. On Oct. 9, considering herself gravid she had an abortion induced. The attempted interruption of her pregnancy was followed by uterine bleeding on the fourth day thereafter, the amount was moderate, and it lasted for several days. On Dec. 4, while at stool she was seized with a sharp pain in the pelvis and became un-

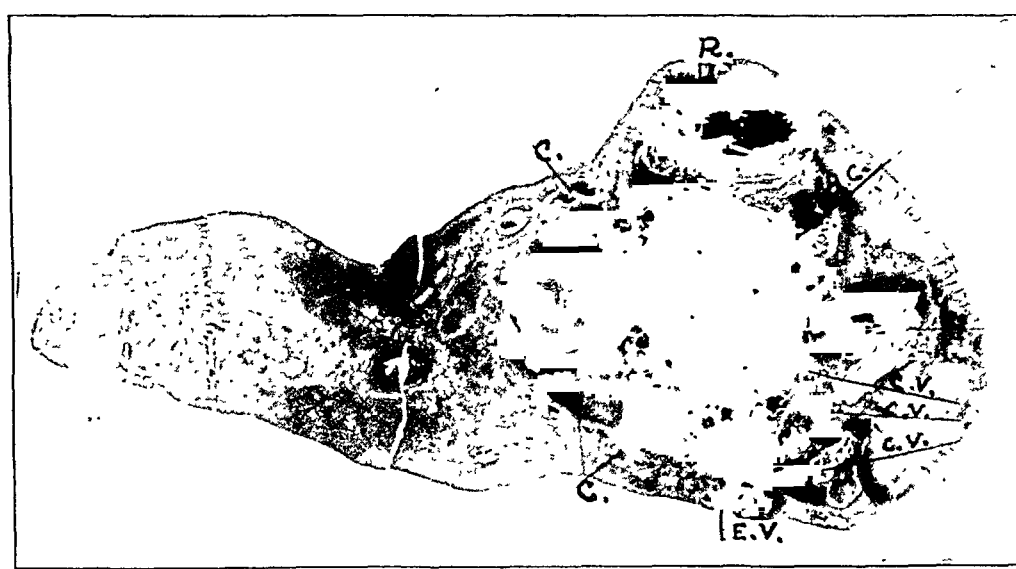


Fig. 34.—Longitudinal section of the ovary harboring the pregnancy. The gestation mass occupies the outer enlarged half, it consists of blood clot (B.C.), chorionic villi (C.V.), and the remains of the embryonic vesicle (E.V.) about the center of the mass. The capsularis (C) is formed by the ovarian stroma. (R.) indicates the site of rupture.

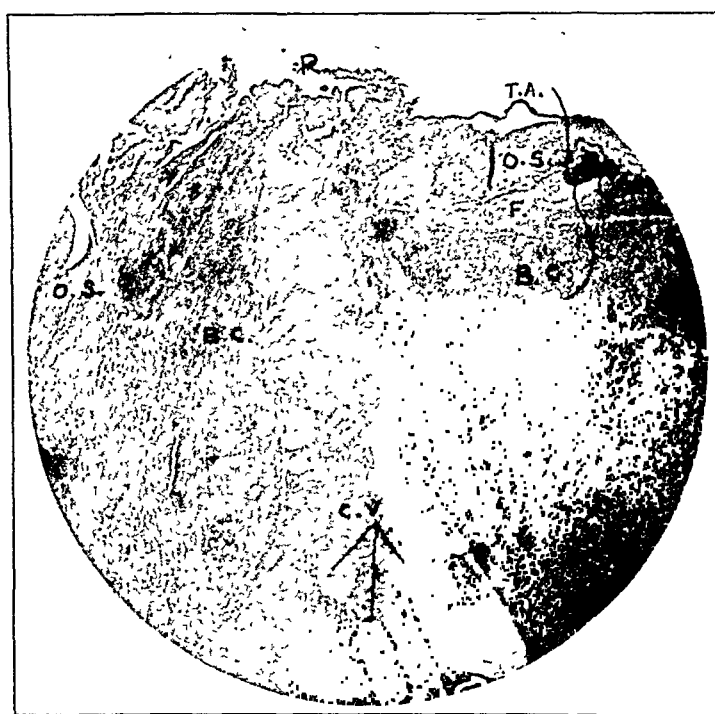


Fig. 35.—High power reproduction of the rupture point in the primary ovarian pregnancy. The rupture is at R. and the pregnancy, indicated by the mass of chorionic villi (C.V.) many of which have undergone hyaline changes, is located in the depths of the ovary. The capsularis (C) is made up of the following constituents, tunica albuginea (T.A.), ovarian stroma (O.S.), fibrin (F.), and blood clot (B.C.).

conscious. I saw her within an hour after the onset of the above symptoms. Inspection showed an exsanguinated patient, with a small fleeting pulse, cold clammy skin bathed in perspiration, and a clouded sensorium. The diagnosis of intraabdominal bleeding was so evident that no time was wasted in making a vaginal examination. After administering a dose of morphine hypodermically she was dispatched

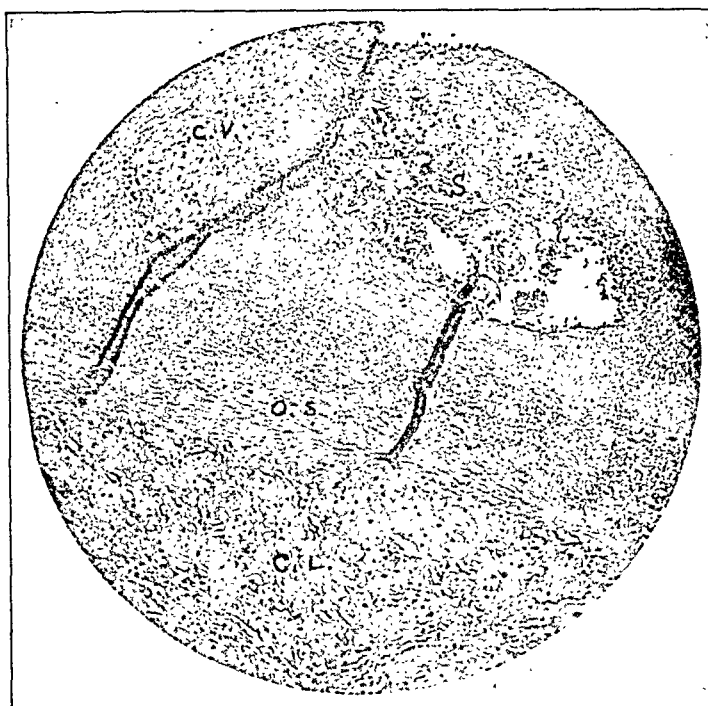


Fig. 36.—Primary ovarian pregnancy. The corpus luteum (*C.L.*) is separated from the gestation mass, consisting of clumps of syncytium (*S.*) and chorionic villi (*C.V.*), by a broad strip of ovarian stroma (*O.S.*).

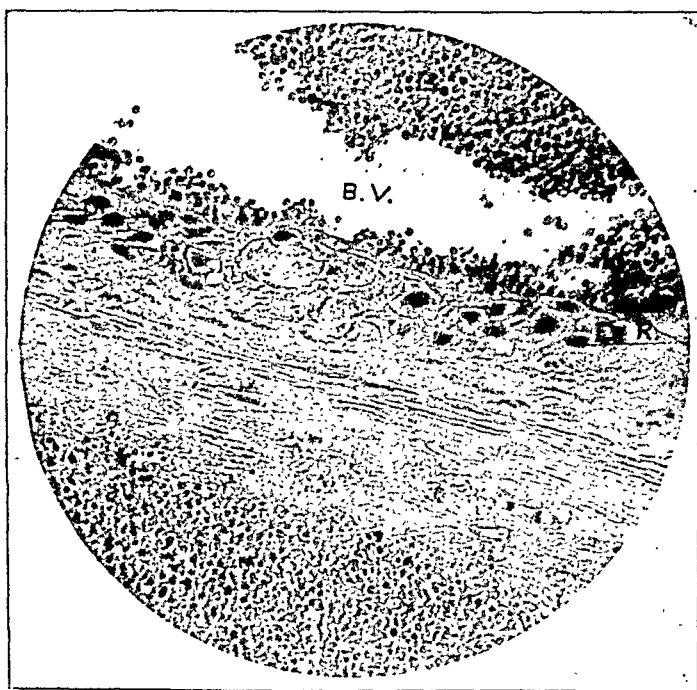


Fig. 37.—Blood vessel (*B.V.*) wall in ovarian pregnancy showing a subendothelial decidual reaction (*D.R.*).

with all haste to the hospital and directly to the operating room. As soon as the operative field was prepared I performed a laparotomy and found the abdominal cavity filled with blood, which came welling up from a rupture point in the outer pole of the left ovary. The left adnexa were removed, the uterine end of the right

tube resected, to prevent further conceptions, the free and clotted blood evacuated, and the abdominal incision closed. The recovery was uneventful. The specimen (Fig. 33) consisted of the left uterine adnexa; the fallopian tube was normal, its abdominal end patent and free, and the mesosalpinx the seat of a small mesenteric cyst. The ovary measured 4 by 2.5 by 1.5 cm. Its outer half was dark blue in color, due to suffusion of blood into the stroma, the hemorrhagic portion measured 1.75 by 2 by 2 cm., nodular, the tunica albuginea tense and in its upper and outer quadrant was the point of rupture, as large as a split pea. The outer two-thirds of the ovary (Fig. 34) harbored the ectopic pregnancy, consisting of blood clot, chorionic villi, trophoblast and débris. The capsularis (Fig. 35) was formed by the ovarian stroma covered externally, except at the point of rupture, with the germinal layer, and on its inner surface was in contact with the products of gestation. The corpus luteum of pregnancy (Fig. 36) did not form a direct constituent of the capsularis, but lay to one side of the gestation area. A subendothelial decidual reaction was present in the walls of some of the blood vessels (Fig. 37), whose lumina were

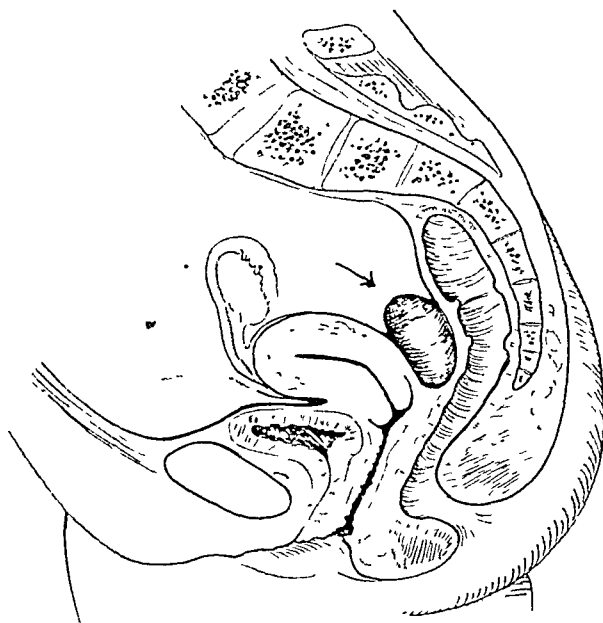


Fig. 38.—Primary abdominal pregnancy, located in the culdesac of Douglas. The uterus and its adnexa are normal.

free from trophoblastic elements, while those containing chorionic villi did not show this proliferation. Epierisis: The normal condition of the tube, the absence of any adhesion between the fallopian tube and the ovary, and the location of the pregnancy within the ovarian stroma, constitute the cardinal morphologic facts, determining a true ovarian pregnancy. It is also very instructive to bear in mind the topical relation of the corpus luteum to the capsularis, about which more will be said later.

CASE 10.—*Primary Abdominal Pregnancy with Intracapsular Rupture.* M. D., age twenty-six, married five years, had one child four years ago and one spontaneous abortion in the fourth month of pregnancy, three and a half years ago. Menses began at the age of thirteen, twenty-eight-day type, lasting two days, painless and scanty; the last period occurred on April 28, 1925. For the past six months she suffered from a progressively increasing dysmenorrhea and oligomenorrhea. Her relative sterility is voluntary. On May 12, she was taken ill with sharp pain in the

lower pelvis radiating to the rectum; this attack lasted for several hours. On May 30, she had another attack and the following day began to stain and expel clots, this bleeding lasted two days. Since June 1, she complained of a constant pain in the

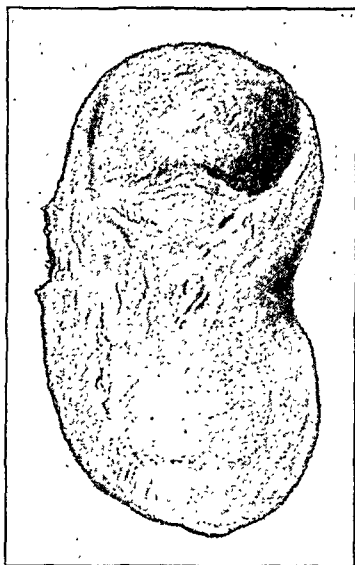


Fig. 39.—Primary abdominal pregnancy. Its surface is smooth, covered by serosa, excepting at the points where it was attached to the adjacent viscera.



Fig. 40.—Primary abdominal pregnancy, showing the chorionic villi (*C.V.*), the free blood (*B*), the fibrin (*F*), and other products of gestation surrounded by the edematous and infiltrated subperitoneal connective tissue (*S.P.C.T.*) layer

lower abdomen, which was worse on walking and during defecation. Physical examination June 9, revealed tenderness over the lower half of the abdomen, no peritoneal rebound, a sausage shaped tender mass in the posterior culdesac, with the uterus displaced upwards and to the left. A diagnosis of left tubal pregnancy was made

and a laparotomy performed the same day. Operative findings: The uterus and its adnexa were normal to inspection and palpation, no blood escaping from either the tubes or the ovaries, and the pelvic contents were very slightly tinged with blood. In the rectouterine space (Fig. 38), an oblong dark bluish tumor mass was present, partly attached to the lower uterine segment anteriorly and to the wall of the rectum posteriorly. Its separation from these fixed points was followed by a moderate amount of oozing which was readily stopped by compression. The specimen (Fig. 39) was bluish red in color, resembling in outline a miniature kidney, it measured 3.5 by 1.5 by 1.25 cm., its surface was smooth excepting at the point where it was attached to the adjacent organs. The cut surface presented the familiar appearance of a blood clot; enveloped by a thin membrane. Within the meshes of the blood clot (Fig. 40) many chorionic villi were seen, in different stages of degeneration, surrounded by a capsule made up of the peritoneal and the subperitoneal connective tissue coats. The outer surface of the capsularis was covered with low cuboidal epithelium, the subperitoneum infiltrated with round cells and blood cells, and the inner surface in contact with the gestation elements.

Epicrisis: The nonparticipation of the uterine adnexa in the formation of the gestation mass, and the subperitoneal nidation of the ovum, established the diagnosis of a primary abdominal pregnancy, beyond the shadow of a doubt.

*(To be continued.)*

*(For discussion see page 143.)*

## THE DIFFERENTIATION OF CANCER TISSUE\*

BY JAMES E. DAVIS, A.M., M.D., DETROIT, MICH.

THE subject will be discussed under three subtopics: (1) The antagonistic and synergistic factors in cancer; (2) The characteristics of cancer tissue; (3) The specific morphologic unit changes in malignancy.

### ANTAGONISTIC AND SYNERGISTIC FACTORS IN CANCER

That the body possesses means for protecting itself against cancer is evidenced by the fact that no natural cause of this disease is 100 per cent effective. The two correlated questions are frequently asked: Why does not everyone have cancer, and why do some persons have cancer? It is obvious from statistical studies that a clergyman or a farmer have much less chance of dying from cancer than have industrial laborers. It is also obvious that there is a closer causative relation of this disease to certain occupational irritants and not to others, for workers in paraffin, dyes, etc., are frequently affected, while those working with lead never or very rarely have cancer.

While statistics easily prove that cancer is most common between the ages of fifty-five and sixty years, yet it grows best in young healthy animals and in their well vascularized tissues.

It would seem as if resistance here should be maximal. On the

\*Presented at the Thirty-eighth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, Hot Springs, Va., September 16, 1925.

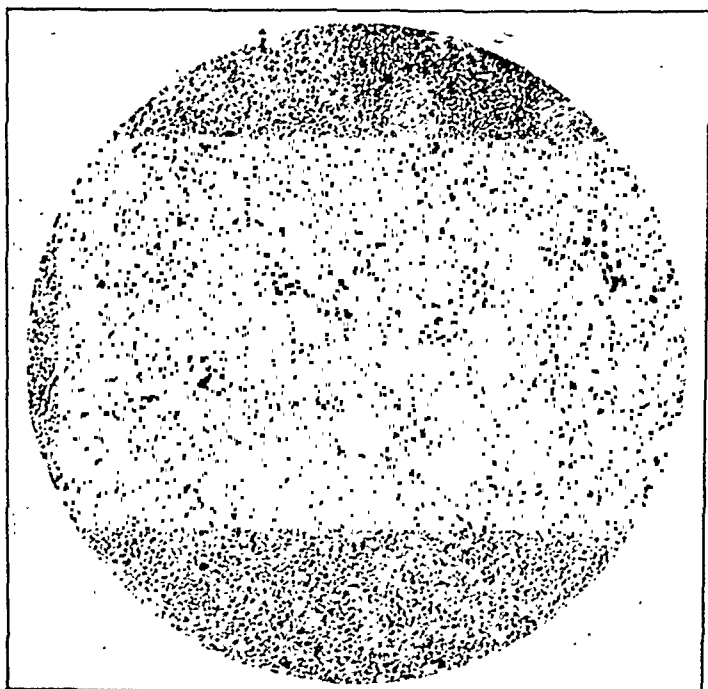


Fig. 1. Left.

Fig. 1.—Sclerous carcinoma of the mammary gland. *Right.* This new growth has stimulated the production of an unusual amount of stroma. The epithelial cells are massed in irregular forms. The individual cells differ in size and form. The nuclei vary in absorption of the stain and preservation.

*Left.* The same tumor as shown on the right actively differentiating in axillary lymph node tissue. The same type of tumor cell can be easily recognized, but the modifying influence of a tissue with but little stroma is quite evident.

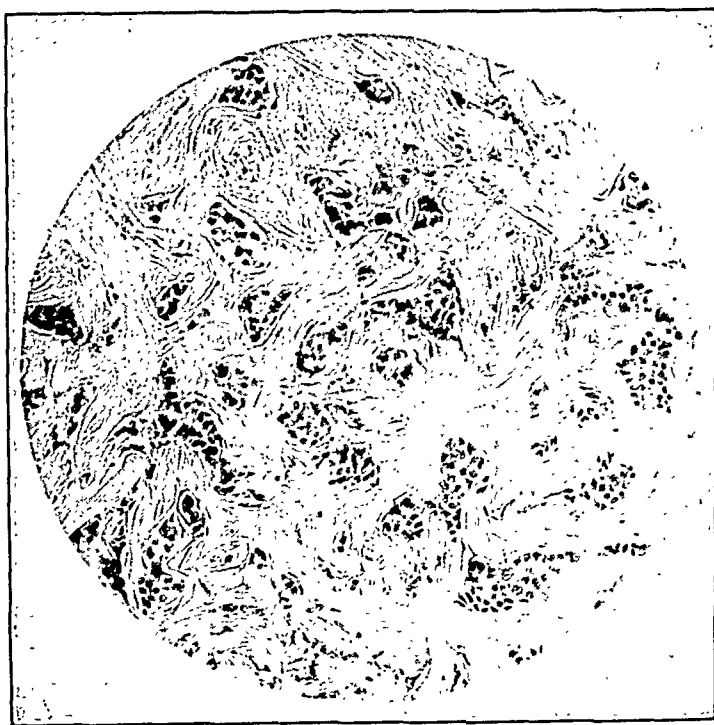


Fig. 1. Right.

Fig. 1.—Sclerous carcinoma of the mammary gland. *Right.* This new growth has stimulated the production of an unusual amount of stroma. The epithelial cells are massed in irregular forms. The individual cells differ in size and form. The nuclei vary in absorption of the stain and preservation.

*Left.* The same tumor as shown on the right actively differentiating in axillary lymph node tissue. The same type of tumor cell can be easily recognized, but the modifying influence of a tissue with but little stroma is quite evident.

contrary, results have shown that even if tissue resistance per se is high, growth impulse of the malignant tissues is higher, owing to superior nutrition supplied their abnormal cells functioning only for growth and multiplication. In old age, lowered function, diminished nutrition, and general biologic conservation are not antagonistic to the causes of cancer, but they are factors impeding its growth.

Much has been said concerning the influence of certain articles of diet aiding the differentiation of cancer tissue, yet no satisfactory proof of this is supplied by vegetarians or by excessive meat eating peoples of Argentina, Australia, and New Zealand, or the meat consuming Eskimos. Horses and cows are exclusively vegetarian animals, but they frequently have cancer.

The effort to attribute the causative background of cancer to heredity and to effects of civilization has not succeeded. In very recent literature many attempts have been made to show that primitive peoples are remarkably free from this disease. The evidence gathered has lacked data very essential for satisfactory proof of this contention. The primitive people applying for medical examinations are relatively few in number and the number reaching and passing the average cancer age is small. The number of necropsies performed upon primitive people is necessarily small. Hoffman<sup>1</sup> has directed attention to the interesting fact that Scandinavia and Switzerland obtain 90 to 100 per cent autopsies, and it is in these countries the cancer death rate is highest.

It must be admitted that blood and tissue resistance to cancer is only relative, for even splenic, muscle, nervous and lymphatic tissues grow cancer, and so also do the tissues in cases of lymphatic leukemia. The fact that a positive and absolute autogenic control of cancer is possible needs no other proof than is afforded when the fetus in utero dies and the somatic control substance causes cessation of chorionic growth even in malignant chorionepithelioma.

The experimentalist, working intensively in a favorable field, can break down the resistance of nearly every mouse to cancer by a sufficient number of applications of tar, but men and mice both need to have their skin irritated for about one-fourth of their lives before there is much liability of its becoming cancerous.

Ewing<sup>2</sup> sums up the restraints to growth, saying they have at least four factors:

1. Mechanical pressure of cells on each other
2. The distribution of nutriment
3. The influence of specialized functions
4. Organization

In discussion of these factors he aptly comments upon No. 2, saying: "There is extreme fibrosis of the ovaries in many cases of mammary



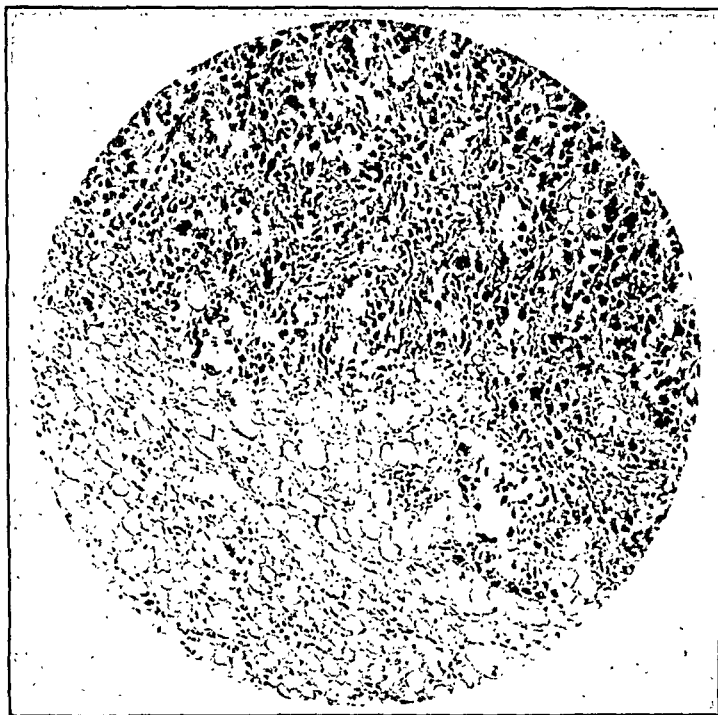


Fig. 2. Right.



Fig. 2. Left.

Fig. 2.—Carcinoma in liver and fat tissue.

*Right.* Approximately the right one-half of the section is infiltrated with poorly differentiated tumor cells and but slightly formed tubular glands. In this loose areolar fat tissue the antagonism to differentiation is less than in the companion picture on the left, where the growth is in liver structure.

*Left.* The perlobular vascular structures are not yet invaded, mainly because of their muscle tissue.

cancer," and upon No. 3 as follows: "Normal function diverting the energies of the cells must be a constant restraint or regulator of growth. In most organs certain groups of cells are set apart for growth, e.g., germ center cells of lymph-nodes, cells at bases of intestinal villi, and the basal cells of the epidermis." He illustrates *Organization* (No. 4) by pointing out that "all known features of a malignant neoplasm are exhibited by the normal chorion, even the destructive invasion and cachexia, but the process is not a tumor *because of its purpose* which shows it is under control of the organization."

#### CHARACTERISTICS OF CANCER TISSUES

The cancer of one individual differs from the cancer of another individual just as widely as do their respective tissues, and so does the malignant growth in one organ differ from that in another organ. Also, the new growth arising in one tissue will usually strive to repeat the morphologic type of its mother tissue, but, as it differentiates new cells in another though contiguous structure, the conformation to its new environment may be unusually close. The rapidity of a malignant growth in different tissues may vary with the richness of blood supply, the irritation it sustains and the tissue in which it grows. Cancer will grow in muscle and splenic tissues, but it is seldom found thriving in such structures. It is interesting to remember in this connection that the liver, the largest gland of the body, is infrequently the site of primary cancer growths. This is especially true throughout America and Europe, but in the Orient there is relatively considerable frequency of its occurrence even in children.<sup>3</sup> The general infrequency of liver cancer may be due to the liver's increased ability to fix and render foreign proteins harmless.<sup>4</sup>

Then again, malignant tumors may grow well in fat tissue but do not easily originate there.<sup>5</sup> It is claimed that the groin and the upper part of the thigh are the most common seats of atypical lipomatous tumors (liposarcomas).

There is a marked variation in the frequency of cancer in the different tissues. Wilson<sup>6</sup> has compiled 1,430 cases of malignant tumors of the thyroid from the world's literature prior to 1921. In 74,335 necropsies the frequency of malignancy of the thyroid was 1 in about 385, and the majority of these tumors seemed to be primary. A metastatic involvement of the thyroid is considered a curiosity, and metastasis of hypernephroma to the thyroid is the rarest of all tumors so metastasizing.<sup>7</sup> Metastasis from the thyroid takes place early and quickly into bone and other tissues.

Carcinomata of the head and face tend to remain local, but it is estimated that 90 per cent of skin cancers develop on the unprotected



Fig. 3. Left.



Fig. 3. Right.

Fig. 3.—A polynorphous epidermal carcinoma of the esophagus. The growth involved both the mucosa and muscularis causing a board-like rigidity of the tube from the lower border of the thyroid to the level of the tracheal bifurcation.

*Left.* The stratified epithelium extends deeply by tongue-like processes into the submucosa. The regularity of the basal cell layer has changed. A sharp contrast is seen between the organization prevailing in the greater portion of the left and right halves of the field. Variation in size and shape of the cells is apparent.

*Right.* In this field the unusual number of large cells and a central band of newly grown connective tissue are seen.

parts of the face and neck. The lower lip is said to be the site of  $33\frac{1}{3}$  per cent of all skin cancers.

Bells<sup>8</sup> says: "Malignant neoplasia in the human is a biologic atavism."

Rohdenburg<sup>9</sup> states: "The basic difference between a malignant and benign cell is continuity of cell division without cessation. Cells are killed when the chronic irritant acts upon the tissue. A neoplasm starts after chronic irritation in a susceptible tissue. Emphasis is placed upon the susceptible tissue or susceptible individual, for this seems to be the all-important factor. The killing of cells is repeated and repeated within the same small area. When the tissue cells die, they either become acid or less alkaline than the adjacent living cells. As the dead cells autolyze, the product becomes more acid. The body fluids tend to neutralize this acidity and ultimately a growing tumor demineralizes the body. This added inflow to the cell creates a chronically overfed cell with resulting division and repeated division.

"Dead homologous protein, with the living and dead heterologous protein, hypermineralize the blood and the cancer cell contains 10 to 13 per cent more salt than does the normal cell. Neoplasia, then, is a condition of changed metabolism, characterized by hypermineralization."

The essential factor in the precancerous change is the condition of the connective tissue. Epithelium cannot nourish itself properly from the body fluids without depending upon the connective tissue for nutrition: it might be described as an obligate parasite on connective tissue. It cannot grow by itself without the addition of the connective tissue. In this connection, Wood<sup>10</sup> has observed that the stroma, which is a nonspecific comparatively inert connective tissue, supports the blood vessels, and this is the only functional relation of the normal and the tumor tissues, lymph vessels and nerve fibers being usually absent. The quantity of stroma appears to depend upon the stimulation given by the parenchyma, and tumor tissue parenchyma grows more rapidly than its stroma. Bashford<sup>11</sup> believes: "The cancer cell is a biologic modification of the normal cell endowed with many inherent properties of the latter. But it has ceased to be functionally important to the body. In form it varies from the normal but slightly and then on to the unrecognizable. In organization, the definite plan followed by all normal cells is abandoned and the body is depended upon only to supply the tumor cells with nutrition."

W. Blair Bell<sup>12</sup> observes that: "Whatever causal factor, whether metabolic or extrinsic, can permanently impair the cell without killing it, may be regarded as a predisposing cause of malignancy." And further: "What happens to and in a cell driving it to adopt an unnatural, malignant course of life? A healthy cell does not do this, a dead cell cannot. There is, however, an intermediate state."

Greenough<sup>13</sup> summarizes the factors that enter into the determination of the degree of malignancy of cancer of the breast as follows:

1. By histologic study of the original tumor, three classes, low, medium and high malignancy can be distinguished.
2. Degree of differentiation.
3. Degree of secretory activity, as shown by vacuoles and droplets of mucoid material.



Fig. 4. Right.

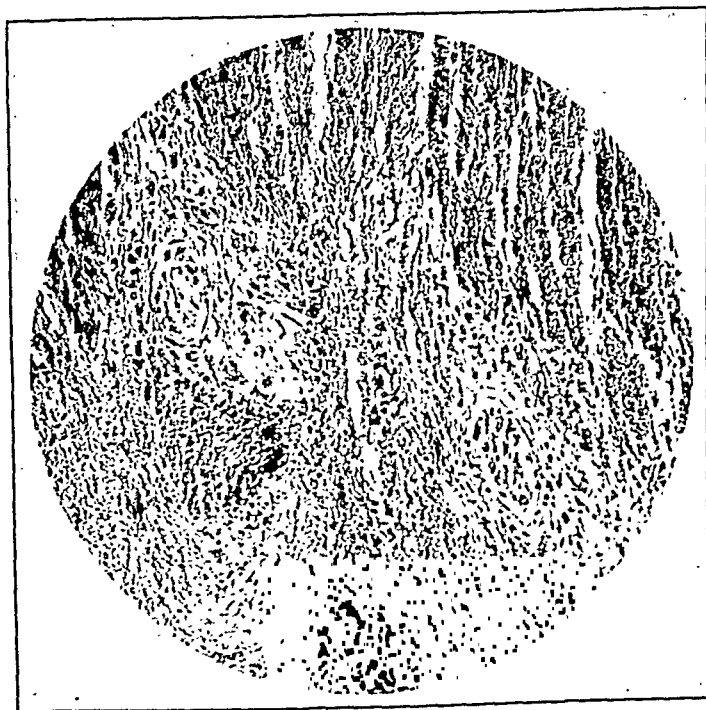


Fig. 4. Left.

Fig. 4.—Adenocarcinoma of the sigmoid colon.

*Left.* Undifferentiated new-growth cells invading the muscle tissue.

*Right.* The new growth is differentiated into abnormally shaped glands, and the individual cell units are irregular and incompletely arranged. The marked tendency to degenerate is quite evident. The compactness of the stroma and aged appearance of the cell nuclei can be plainly seen.

4. Uniformity of size of cells and of nuclei, as opposed to variation in size.
5. Absence or presence of hyperchromatic changes in nucleus and few or many mitotic figures and whether irregular or not.
6. High malignancy is shown by cells and nuclei of irregular shape and size without secretory function, and arranged in solid columns, large or small together, with numerous and irregular mitoses and hyperchromatism.
7. Round-cell infiltration indicates cell degeneration rather than resistance.
8. Hyalinization of the stroma is a factor of age rather than of resistance.

Though there is infinite variety in the forms of cancer, yet there are certain features based upon principles of construction common to all, viz.:

1. It begins at one point.
2. It begins as a local disease.
3. It spreads centrifugally by permeation and embolism.
4. All cancers are composed of cells with type characteristics imitating the tissue in which they began.
5. All cancers are distinguished by a reversal of development shown in the inferiority of their cells, which appear unfinished and even embryonic. The more simplified or debased, the greater the malignancy.
6. The shape, size, internal construction and staining properties of the cancer cell and nucleus approach those of the cell and nucleus of embryonic, vegetative or unicellular type.
7. The highest degree of malignancy as a rule goes with the most cellular neoplasms, and the smallest and roundest cells, which stain intensely and show very active mitoses resembling some vegetable cells.
8. The reduced cells of the cancer are more akin to the lower class cells than to the cells of the higher order from which they sprang, and are therefore not so chemotropic to them.
9. Normal embryonic tissues cultivated in vitro continue to grow indefinitely, whereas in similar circumstances cancer cells undergo molecular degeneration.
10. Cancer cell degeneration is correspondingly as rapid as its generation.
11. Molecular decay is conspicuous in cancers injured or exposed to bacterial invasion.
12. Cancers outrun their blood supply.
13. Cancer cell proliferation is always a backward and never a forward change.
14. Cancer excites local tissue opposition.

The most important structural characteristics of cancer are those which show reversal and incompleteness of type. The cells do not become embryonic but they do become embryonoid. The degeneration change is but partly completed. It stops short of molecular degeneration in its regressive movement and proceeds to multiply incessantly. It is the only form of senilism which (1) begins locally in independent cells and (2) spreads centrifugally with but little regard for anatomic boundaries.

The dissemination of tumor cells into the vascular coats, according to Goldmann,<sup>14</sup> is effected by blood vessels. "In arteries the tumor cells rarely proceed further than the outer coat, whereas in veins they are generally found beneath the intima." Tumor-cell infiltration then

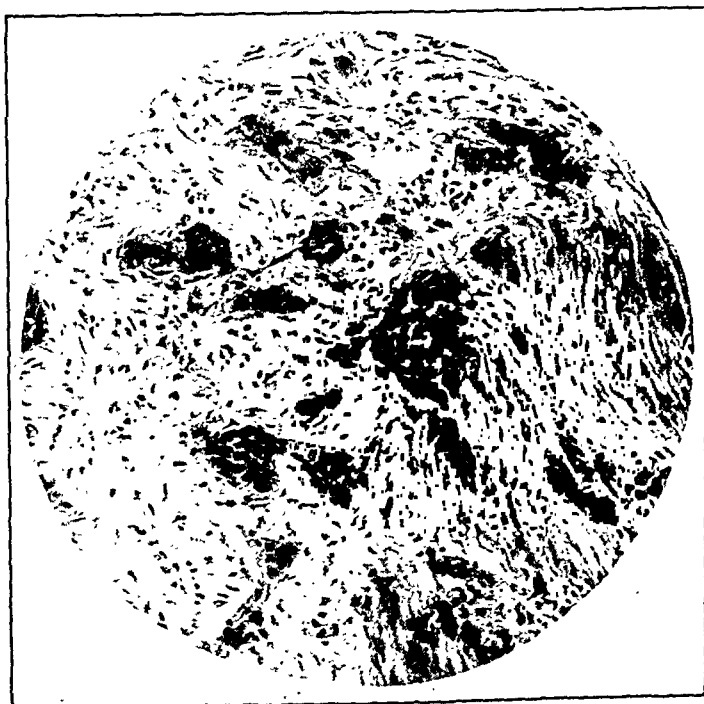


Fig. 5. Left.

Fig. 5.—Carcinoma of the mammary gland and pectoralis muscle.

*Left.* The lower left one-third of the field shows the muscle with consuming cancer cells in mass formation. The remaining two-thirds of the tissue shown has been transformed into connective tissue structure excepting where masses of cancer cells prevail.

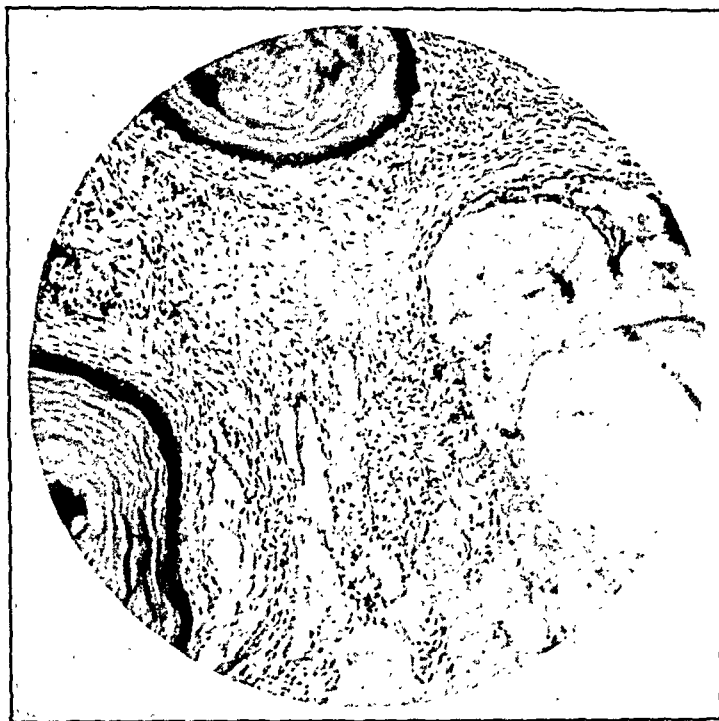


Fig. 5. Right.

*Right.* On the left side the ductal epithelium is markedly degenerated and mucoid degeneration prevails.

into the walls of channels bounded by elastic tissue is a feature characteristic of malignant tumors only.

It is accepted that the vasa vasorum in arteries remain within the limit of the outer coat, rarely branching into the superficial layer of the middle one, whereas in veins they extend beyond the middle coat into the region of the intima. In fetuses and newborn infants there is no material difference between arteries and veins as regards their nutrient vessels, but after the first year the differentiation is accomplished. Virchow observed that arteries act as isolators of pathologic processes, but all this is changed as soon as pathologic processes arise in the artery from within or without. Then the connective tissue, and above all the vasa vasorum, begins to proliferate.

The second important point is that the regular distribution of blood vessels is disturbed by the invading growth. Tumors may show an extensive new formation of blood vessels. This is most important in the zone of proliferation, which in infiltrating tumors is at the periphery.

An infiltrative growth causes great commotion in surrounding blood vessels, particularly in strongly vascularized tissues, such as mammary gland or muscle. The vessels are dilated, thrown into spirals, and develop numerous capillary offshoots towards the invading growth. In cancer the vessels are arranged almost entirely in the peripheral area. As the volume of growth increases, the vessels decrease. In necrosis the vessels tend to disappear totally.

In sarcoma, the numerous vessels are evenly distributed throughout the entire growth as a delicate, closely-woven network.

Bashford demonstrated that the stroma of experimental tumors owed its origin to the inoculated animal, but the structural characteristics of the stroma are determined by the tumor cells.

When the vascular reaction is below normal or fails to take place, Thiersch has called this premature senescence of the connective tissue in cancer.

Reactive power is judged by the stroma formation as well as by degeneration.

#### SPECIFIC MORPHOLOGIC UNIT CHANGES

Differentiation is change from the general to the special—in type of cell, type of tissue, type of organ, and type of animal. During the developmental and so-called fixed states, antagonism exists between epithelial and connective tissues. Broders, Judd<sup>15</sup> and others have used the degree of differentiation to estimate the grade of malignancy, e.g., if there is 75 per cent differentiation and 25 per cent without differentiation, the cancer belongs to Grade I (mildest type). If differentiated and undifferentiated tissues are equal, the malignancy belongs to Grade II. If 75 per cent of the tissue remains undifferen-



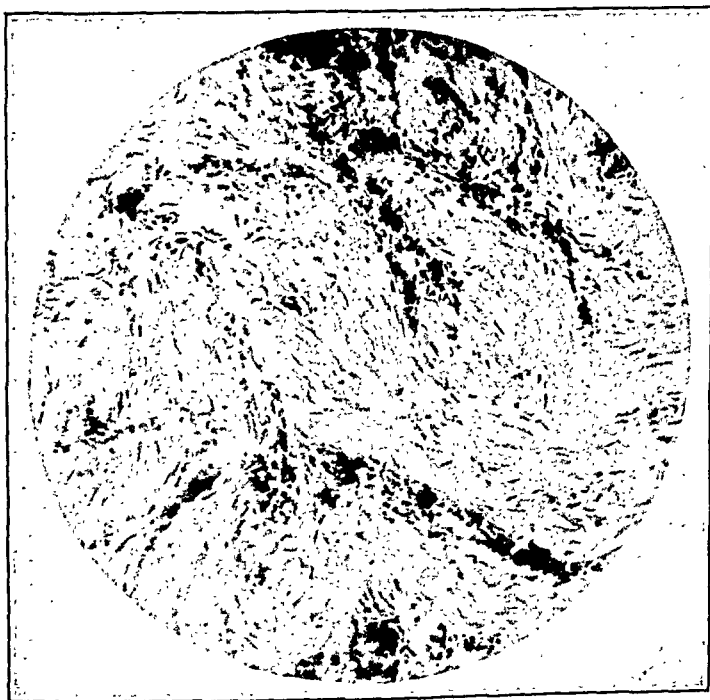


Fig. 6. Left

Fig. 6.—A papilliferous cyst adenocarcinoma of the ovary.  
*Left.* An area of firm stroma with irregular masses of invading carcinoma cells without differentiation, comparable to that seen on the right section.



Fig. 6. Right.

*Right.* Compact, aged stroma on the left with bizarre gland forms on the right rapidly degenerating.

tiated, the cancer is called Grade III. When there is no differentiation, then malignancy is severest.

Besides the degree of differentiation, the type of cell can sometimes indicate the degree of malignancy. Martzhoff in 1923 studied the histomorphology of predominating cells in epidermoid cancer of the cervix uteri and concluded that the spindle-cell type was least malignant, the transitional cell more malignant, and the fat spindle-cell type most malignant of all. Epithelial tumors depart less from the primordial type, hence their cells still retain their primitive powers of growth and multiplication in a higher degree than others.

MacCarty<sup>16</sup> believes the body is composed of at least forty-five different types of cells, characterized by evolution, fertilization, segmentation, differentiation and specialization.

Differentiation is divided into three recognizable stages:

1. General alignment of cells (as in the normal adult tissue in undifferentiated form).
2. Cellular polarity (as in fully differentiated tissue).
3. Adult morphology.

In postoperative cases of cancer MacCarty observed life was prolonged when differentiation was present. This was especially true of skin cancers, for the cases without differentiation lived 274.7 days, while those with differentiated tissue lived 534.1 days, or 259.4 days longer.

Levine<sup>17</sup> states that "uninucleate or multinucleate giant cells constitute an important part of cancer tissues. That these cells may give rise to pluripolar spindles and hyperchromatic cells is likely. These cells are not degenerating cells, as claimed by earlier workers, but are found associated with some increased metabolic process in the growth of the malignant neoplasm. Malignant neoplasms in man are characterized by rapidly dividing cells with aberrant types of division. The cells that make up the growth may have developed in situ or have come through the blood and lymph channels from distant parts of the body. These cells are endowed with a progressive proliferating power and die with the host. Plant overgrowths resulting from infection with *B. tumefaciens*, etc., are due to rapid but normal division of cells. Atypical divisions are not found in these tissues. All cells in infectious plant neoplasms differentiate, reach maturity, become senile, and die independently of the host."

Fischer<sup>18</sup> of Copenhagen has shown that in the culture of fibroblasts the average of mitotic cell divisions in a given time in the peripheral zone was 2 per cent, and Haberlandt<sup>12</sup> found in the cultivation of plant tissue cells in vitro that single isolated plant cells were not able to divide until they were in contact with certain other plant tissue elements, but various types of sarcoma cell are able to divide in vitro when isolated and scattered.

While malignant cells have been cultivated in vitro by Carrel and Burrows<sup>20</sup> (chicken sarcoma, rat sarcoma and the Flexner-Jobling rat carcinoma) Lambert and Hanes<sup>21</sup> (mouse carcinoma) and Losee and Ebeling<sup>22</sup> (a human sarcoma), all agree that it is rather difficult to keep tumor cells growing outside the body. Living cells require minute quantities of certain special substances derived from organic matter to maintain life and active proliferation. Therefore the rate of growth of tumors in animals can be appreciably increased by inoculating a substance derived from the breaking-down products of tumor cells. It has been known for more than fifteen years that two apparently opposite biologic effects may result from the absorption

of tumor material. An animal may become effectively protected against tumor growth, or it may become sensitized so that a tumor grows in it more rapidly than in a normal animal.

Sokoloff<sup>23</sup> distinguishes two kinds of cells in cancer tissue. One type is related by its qualities to the cells of the embryo. Such cells are active, possess a high degree of vitality, and probably cytologically and morphologically are closely related to embryonal cells. The second type of cells observed in tumors are those which exhibit a condition of disintegration of the formed elements so that the normal morphology is entirely distorted by these probably dying cells. The character of the tumor, its size, and the degree of its malignancy, are in a considerable measure determined by the correlation between the cells of these two types.

A large number of writers, including Sokoloff and Cartotto<sup>23</sup> have observed the glycogenesis of cancer cells and the importance of the cellular lipoids in relation to cellular anarchy and cellular activity. Studies of the mitochondria in tumors show



Fig. 7.—Carcinoma gelatinosum. This tumor was characterized by rapid growth, large size and a corresponding rapidity of degeneration. The production of mucus exceeds the amount of stroma and epithelium in the field. The epithelial cells and their organization into gland forms show good differentiation.

that their biologic and physiologic properties are correlated with those of healthy cells in a state of active growth. Cancer cells can be divided into four types:

1. Young cells with small nucleimitochondria, absent or almost invisible.
2. Strongly marked embryonic characters and larger nuclei-mitochondria, larger in number and size, appearing as rods or granules.
3. Depressed cells with indistinct nuclear outlines, mitochondria almost invisible.
4. Cells in the course of complete disintegration.

Ewing<sup>24</sup> says: "Embryonal cells possess more than any others the essential factors of tumor growth. This is perhaps the most important single fact of our knowl-

edge of tumor genesis. It would seem that tumor genesis were chiefly a question of the mechanics of development. The complete emancipation of malignant neoplasms from the normal laws of growth *remains the obscure and essential element.*"

Ribbert<sup>25</sup> has insisted that no unusual power of proliferation exists in cancer cells, that these cells freed from the restraints of tissue tension are merely exhibiting the powers of growth with which they are endowed from the ovum.

#### SUMMARY

1. Cancer cells or cancer tissue cannot be differentiated either in vivo or in vitro from dead cells or from normal cells.

2. Two genetic sources undoubtedly supply the units of cancer formation, namely the injured and the embryonic cells.

3. It is plausible to believe that heredity may supply in certain families and individuals protoplasm of low potential quality for ultimate differentiation, and the physical evidence will appear in the abnormal number of cells unable to gain maturity.

4. The preponderance of evidence and modern opinion point to irritation, regardless of its type (whether traumatic, thermic, chemical, bacteremic or parasitic), as the exciting cause, which can act with equal facility upon embryoid or atavistic type of cells in producing uncontrolled, incompletely organized, dysfunctioning tissue.

5. Under the conditions prevailing in cancer, function no longer determines form, but conversely, form determines function, which is inadequate, abnormal and superfluous.

6. With inadequate tissue organization, lacking as it does nerve and lymph supply, and possessing a precarious blood vessel canalization, supported by an uncertain stroma and exercising free parasitic characteristics, there can be little wonder that degenerative changes are constant.

7. The chemical activities of cancer tissues tend towards acidification of body fluids with consequent body demineralization and cancer tissue hypermineralization.

8. The differentiation of cancer cells can be advantageously studied by estimating both the number of the new growth cells differentiated and their nearness or remoteness to normal standards of form.

9. Observation of the cell division figures and the degenerative changes in nuclei affords useful information as to rapidity of growth.

10. It should be expected that cancer cells will differentiate after the pattern of their parent tissue, but frequently the influence of a new environment compels a close resemblance to surrounding structures but occasionally no imitation of either is recognizable.

11. The kind of food consumed or the mode of life pursued have but little to do with the development of cancer.

12. The better nutrition supplied by younger subjects is the greatest factor in producing a maximal growth impulse in malignancy.

13. Growth, pressure, nutrition, specialized function and organization, all represent central, general, purposeful provisions for the body, but malignant growth has no purpose in the body economy.

14. The cancer tissue may repeat or depart from its pattern form. It may or may not be influenced by its environmental structures.

15. Tissue susceptibility to cancer varies widely and metastasis from different anatomic locations is often distinctive.

16. The connective tissue is the only functional relation of the normal to the tumor tissues and reaction to the cancer can be judged by the stroma formation as well as by degeneration.

17. As epithelial cells depart less from their primordial type, they consequently have a greater potential and actual growth impulse.

18. *Differentiation, which is a change from the general to the special in type of cell, tissue, organ, and animal, is always incomplete in all four types if it is cancer tissue.*

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# THE CLINICAL AND PATHOLOGIC FEATURES OF PUBERTY HEMORRHAGE

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PUBERTY bleeding clinically designates menorrhagia or metrorrhagia occurring early in menstrual life. These abnormalities are locally independent of inflammation, neoplasia and the pregnant state, as well as of the varied blood dyscrasias. They are closely allied to the essential bleeding occurring at the menopause and clinically as well as pathologically both forms overlap. In this communication the puberty group is stressed.

A review of 26 cases from the gynecologic services of the General Memorial and Long Island College Hospitals emphasizes the following characters of this disease.

1. Primary menstrual anomalies: Both menorrhagia or metrorrhagia may set in as the initial epoch of sex life or supervene more slowly following oligomenorrhea, hypomenorrhea or other disorders of menstruation.

2. Absence of abnormalities in the general physical examination: This is true in the great majority of cases; yet two in this series showed definite endocrine dyscrasia. Though only fourteen years of age, both of these girls were fully matured, with mammae well formed, the external genitalia fully developed, and the uterus large. The unusual height, 5 ft. 10 in. in one and 5 ft. 6 in. in the other were indicative of abnormal pituitary stimulation.

3. Normal bleeding and clotting time. These tests were performed where secondary anemia was unduly severe and as a rule prior to transfusion. In six instances the findings were within the normal.

4. Pelvic abnormalities: In all cases, the cervix was found unusually soft and patulous. In addition several were noted with enlarged uteri. In all the curettings were abundant and hyperplastic.

5. Recurrence of symptoms after curettage was the rule where abrasion was performed as a therapeutic measure.

6. Excellent therapeutic response, with control of symptoms by radium was universal, even though small quantities were employed.

These features are well demonstrated in seven typical cases abstracted below.

CASE 1 (L. I. C. II., 1921, No. 2966).—Menorrhagia the initial epoch of menstrual life, persisting until relieved by treatment.

Miss M. H., aged fourteen years, was admitted to Dr. Gibson's service at the Long Island College Hospital, June 9, 1921. Her first menstruation began profusely one month before and continued to date of admission. Hemoglobin, 30 per cent; bleeding and clotting time normal. Physical examination was negative. Under anesthesia the pelvis was found normal except for a patulous cervix. Curettage yielded two teaspoonfuls of large endometrial fragments. Twenty-five mg. of radium were inserted in the uterus for ten hours (filter of 1 mm. of brass and 0.5 mm. of silver). Menstruation since has been regular, lasting four to five days.

CASE 2 (L. I. C. II., 1919, No. 1408).—Primary menorrhagia followed by metrorrhagia; curettage unsuccessful; relief for three years following radium; recurrence, controlled by second dose of radium.

Miss H. F., aged seventeen years, was admitted to Dr. Polak's service at the Long Island College Hospital Sept. 17, 1919. Menstruation began at fifteen, occur-

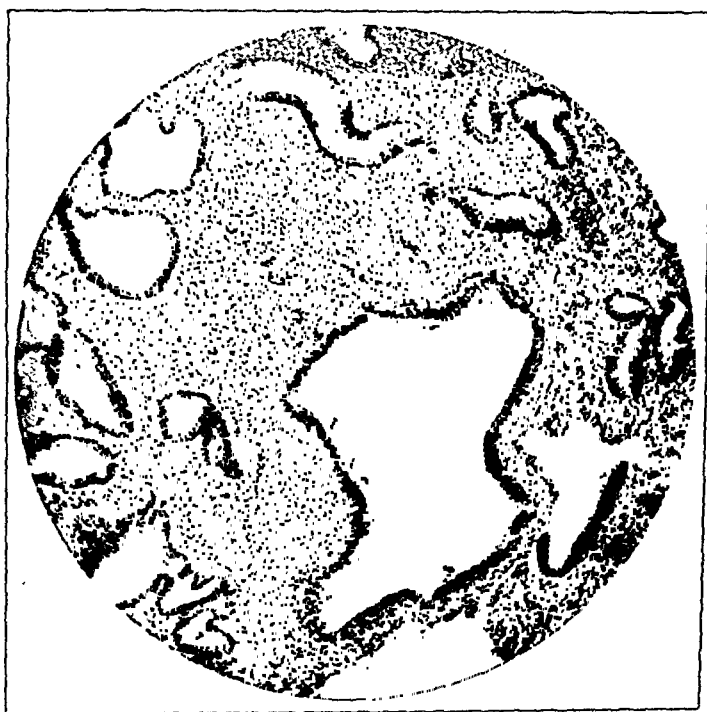


Fig. 1.—(Case 1.) Note hyperplasia of glands and stroma. The huge glands are noteworthy of endometrial hyperplasia.

ring twice each month for seven to eight days for the first year, then every two to three months until six months before. Since that time patient bled daily. A curettage two months after onset did not relieve the bleeding. Hemoglobin was 80 per cent. General physical examination was normal. Under anesthesia the uterus was found soft and enlarged, with the cervix patulous. A large amount of polypoid endometrium was removed. Radium dose of 250 mg. hours was administered through a filter of 1 mm. brass and 0.5 mm. silver. Until September, 1922, periods came every twenty-eight days, four days' duration. At that date, metrorrhagia recurred and continued daily until January, 1923. A second treatment of radium of 400 mg. hours through 1 mm. of brass and 0.5 mm. of silver, resulted in the return to a normal cycle to date.

CASE 3 (L. I. C. H., 1919, No. 1537).—Severe initial metrorrhagia requiring curettage and transfusion. Persistence of menorrhagia followed by metrorrhagia; control and cure by radiation.

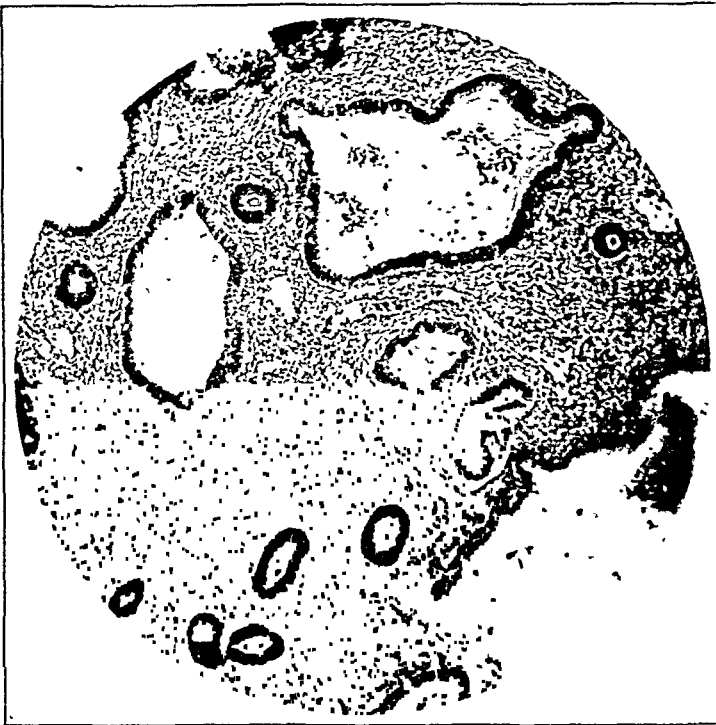


Fig. 2.—(Case 2.) Stroma and glands are hyperplastic. The cyclic pattern has been lost, huge glands are prominent. Note the large numbers of injected capillaries.

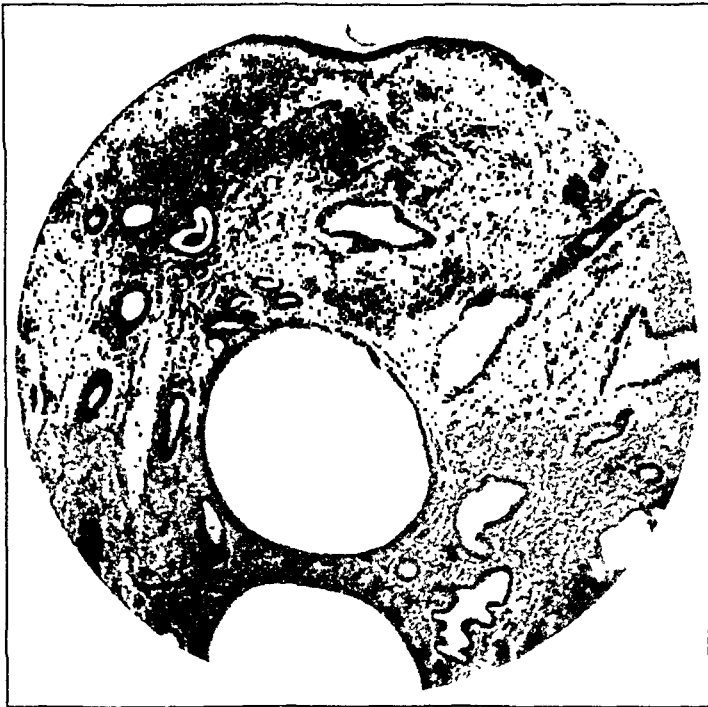


Fig. 3.—(Case 3.) Capillary congestion, glandular and stromal bleeding are all prominent. Note the huge circular glands typical of endometrial hyperplasia.

Miss E. D., aged thirteen years, was admitted to Dr. Polak's service February 22, 1919. The first menstruation began April 25, 1917, and continued very profusely. Because of severe anemia a curettage was performed ten days after the onset, followed by transfusion. Periods recurred in August, October and November of 1917, ceasing only after "injections" given by her physician. No further



bleeding occurred until May, 1918. Since that date, periods have been profuse, lasting seven to twenty days, always requiring medical intervention. Last period began February 10, 1919, and continued uninterruptedly until February 22. Hemoglobin was reduced to 32 per cent and red blood corpuscles to 1,980,000. Coagulation time was six and one-half minutes. A transfusion of 200 c.c. was given and the bleeding gradually ceased February 29, but recurred more severely on March 27. The patient was readmitted March 31. As previously, physical and pelvic examinations were negative. At operation the cervix was patulous and polypoid masses of endometrium were removed by the curette. A 600 mg. hour treatment of radium was given (filter 1 mm. brass and 0.5 mm. of silver). In April and May, periods lasted six days and the flow was moderate. From June 30 to July 5 bleeding was severe but responded rapidly to medication. To date, periods recur regularly and last four to six days; the quantity is normal.

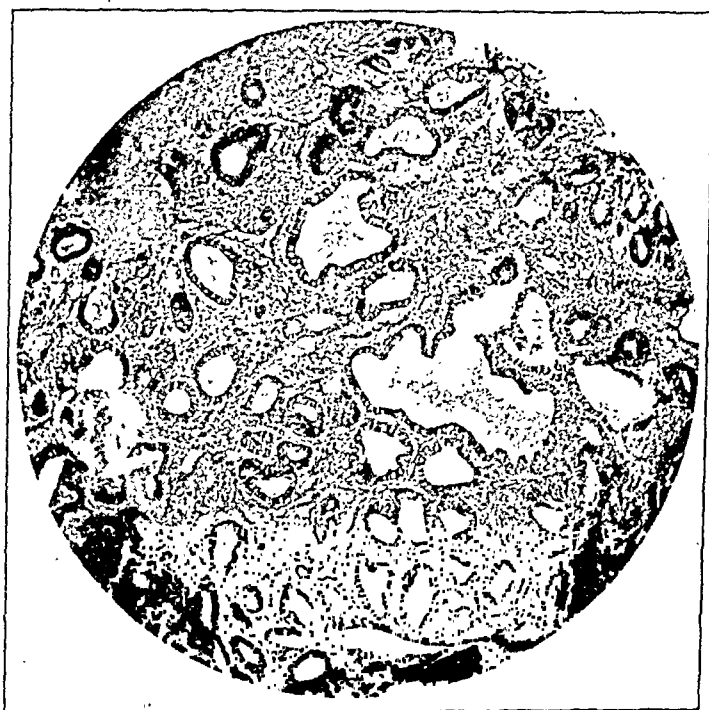


Fig. 4.—(Case 4.) Glandular hyperplasia is prominent. Stroma is congested and edematous. Typical changes of endometrial hyperplasia.

CASE 4 (L. I. C. H., 1922, No. 264).—Initial oligomenorrhea, followed by metrorrhagia; failure of curettage, relief by radium.

Miss E. B., aged twenty years, was admitted to Dr. Polak's service January 14, 1922. Menstruation began at eleven, periods following at two to four month intervals. Three years before, bleeding became continuous, spotting occurring from day to day. Curettage two years before relieved the bleeding for only one month. On admission hemoglobin was 70 per cent and physical and pelvic examinations were normal. A diagnostic curettage revealed a cavity 7.5 cm. in depth; the curettings were abundant and composed of large flakes of endometrium. A 600 mg. hour dose of radium was given (filter 1 mm. brass and 0.5 mm. silver). To date menstrual cycle is normal, the flow lasting two days.

CASE 5 (G. M. H., 1920, No. 2809).—Normal menstruation for one year after onset; menorrhagia, metrorrhagia, curettage unsuccessful, cure by radium.

Miss J. A., aged fifteen years, was admitted to Dr. Bailey's service at the Gen-

eral Memorial Hospital, August 10, 1920. Menstruation began at thirteen and continued regularly until October, 1919. From this date periods lasted thirty to forty-five days with a two to three day interval between. Curettage five months before was unsuccessful. Last period began July 16 and continued to date of admission. General physical examination was negative. Pelvic examinations showed a soft patulous cervix with an enlarged retroverted uterus. Curettage yielded old blood clots and large amounts of endometrium, evidently from the left lateral wall. Radium treatment of 500 mg. hours of emanation was given (filter 1 mm. platinum). Since September, 1920, periods have been regular and of four day duration, except for a transient amenorrhea from April to August, 1921.

CASE 6 (G. M. H., 1922, No. 6183).—Normal menstruation for two and one-half years, menorrhagia followed by metrorrhagia; curettage unsuccessful. Laparotomy. Cystic right ovary resected without result; improvement by radium.

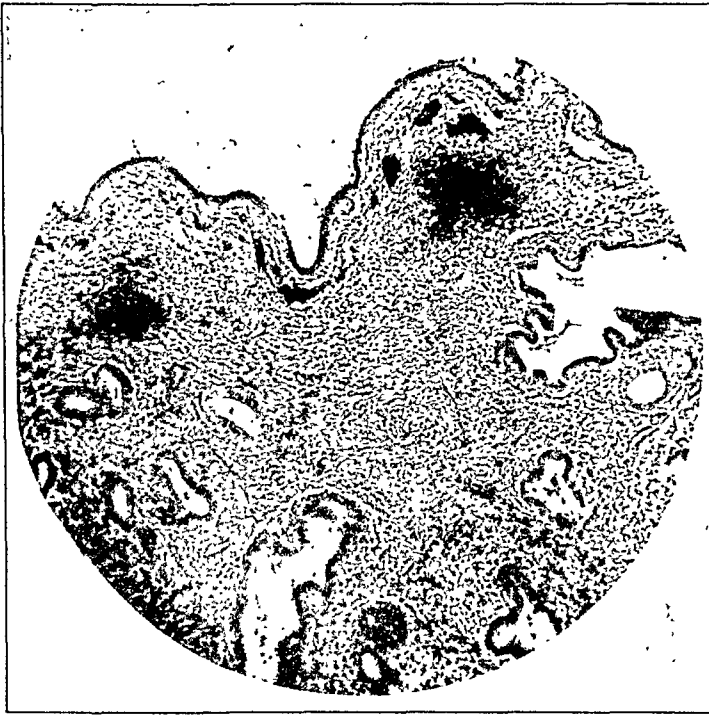


Fig. 5.—(Case 5.) Stromal and glandular hyperplasia is marked. Note the congested capillaries coursing parallel to the surface. Interstitial bleeding is prominent and due to rupture of the vessels.

Miss H. B., aged seventeen years, was admitted to Dr. Bailey's service November 18, 1922. Menstruation began at fourteen, regular every twenty-eight days and of four to five days' duration. In April, 1921, menstruation continued for four weeks. In July the condition returned and lasted three weeks. Last period began November 5 and continued without let-up. On December 17 her physician noted "an enlarged uterus with a soft patulous cervix." There was no response to endocrine therapy and on January 7, 1922, a curettage was performed. The curettings were abundant and the pieces large. A soft projection on the left anterolateral wall gave the impression of a submucous fibroid. Following laparotomy January 16, no fibroid could be found. The right ovary was enlarged and cystic; the large cyst was accordingly resected and the smaller ones punctured. The uterus was suspended. There was no relief from bleeding except for an occasional three to five day period. On admission in November, 1922, the patient had been bleeding for ten consecutive weeks.



Fig. 6.—(Case 6.) Large hypertrophic glands are prominent in the dense hyperplastic stroma. The subepithelial capillaries are engorged; interstitial bleeding is prominent.



Fig. 7.—(Case 7.) Thrombi in the vertical capillaries (c). Necrosis has occurred and the superficial layers of the endometrium are being detached. Glands are huge and the lining cells hypertrophic. Stroma is hypertrophic.

Physical examination was negative. The pelvis was normal and the uterus anterior. Curettage again revealed hypertrophic endometrium. A dose of 445 mg. hours of radium emanation was given (filter 1 mm. platinum). To date, patient menstruates every month for six days but quite profusely.

CASE 7 (L. I. C. H., 1924, No. 3074).—Attacks of menorrhagia and metrorrhagia since onset; abnormality in uterine development; control of symptoms by radium.

Miss M. S., aged nineteen years, was admitted to Dr. Polak's service on May 7, 1924. Menstruation began at fourteen and recurred every two weeks, the flow lasting for ten days, so that the patient was practically never free from bleeding until the age of sixteen. At this time, menses recurred every twenty-eight days and lasted for three days. Between the ages of sixteen and seventeen bleeding was constant. Until three months prior to admission menstruation followed every twenty-eight days for fourteen days. Since then her periods have again become prolonged lasting twenty-one days. Last menses began April 26 and continued to date of admission.

Physical examination was generally negative except for a moderate secondary anemia (Hb. 70 per cent). Rectoabdominal examination revealed a soft cervix of puberty; uterus was anteverted; a tuboovarian mass filled the left vaginal fornix. Laparotomy was performed on May 9. Uterus bicornis unicollis was found; the right tube was normal; the ovary held moderate numbers of follicular cysts. The left tube was clothed with adhesions; the ovary was the seat of chronic perioophoritis. Left salpingo-oophorectomy was done. After closing the abdominal wound, the double uterus was curetted and 25 mg. of radium inserted in the right horn for sixteen hours. Dose 400 mg. hr. (filter 1 mm. brass, 0.5 mm. silver). The curettings were abundant, thick and hemorrhagic. Since operation menses have recurred regularly every twenty-eight days for three days.

With the picture of prolonged and profuse bleeding as presented by the above histories, the cause is naturally carefully searched for in the uterus.

#### PATHOLOGY

It will be recalled that in three instances the uteri were large on palpation and in two others enlargement of the organ was determined by measurement. In the other 19 cases the measurements were not noted, but, as all uteri were sounded before curettage, it is reasonable to assume that any marked departure from normal would have been noted. In all instances the curettings were abundant, and the large size of the fragments noteworthy. A polypoid character was noted in three cases.

The abundance and size of the fragments is explained by the microscopic picture which is almost strikingly uniform in all cases. The details are shown in the accompanying microphotographs.

Many of the endometrial fragments are polypoid and lined by single or multiple layers of hypertrophic epithelium. The remaining fragments are generally thickened. All changes are the result of hyperplasia of the component endometrial structures. The glands are increased in size and numbers. As a rule the cyclic pattern is lost and the glands are irregularly arranged and distributed. There is no recognizable division into a surface, glandular and basal zone as typical of a normal mucosa in the late interval and premenstrual stages. In form, the glands vary considerably. Though most are round or oval, branched and saccular forms are not infrequent. Huge circular glands are prominent and universally found; they are not cystic, as evidenced by the tall columnar cells. As a rule a single layer of columnar cells is found in the glands, but multiple layers (2-6) are not infrequent. The cells are huge with abundant cytoplasm and are almost filled by large, oval hyperchromatic

nuclei. Areas where the glands are within normal size, and regular in form; show the pathologic deviation by contrast of the tall columnar cell with its huge nucleus against narrow lumen. These glands are rather frequent in small polypoid fragments evidently of surface origin. The lumina frequently contains secretion or red blood corpuscles. Secretion is not uniform and adjacent glands of the same endometrium are without secretory collections.

The stroma, like the gland tubules, is universally hyperplastic. Though the cell bodies could not be sharply defined, the enlarged oval, round or fusiform nuclei are indicative of hypertrophy. Mitotic figures are not infrequent and are indicative of cell multiplication. Contrasted to the gland hyperplasia the quantitative ratio is not constant. Glands as a rule show relatively greater hyperplasia. Foci of interstitial hemorrhage often compact beneath the surface epithelium, are a frequent finding. Edema is universally present and accounts in part for the increased thickness of the mucosa.

The vascular changes are especially noteworthy. Capillaries are greatly increased in size and numbers and are generally engorged. Perpendicular loops predominate, though parallel loops beneath the surface epithelium are often seen. Many have ruptured with resulting interstitial hemorrhage, at times so intense as to open directly on the surface. As a rule, however, this is only of sufficient intensity to cause atrophy of the lining epithelium. Thrombosis of the capillaries is occasionally seen both near the surface and in the deeper zones of the endometrium. The significance of this finding will be emphasized in the following paragraphs. Sclerotic venules or arterioles are not infrequent.

In brief, these features of diffuse endometrial hyperplasia are identical with those in the menopausal group. R. Meyer suggests the basal layer as the earliest seat of the lesion.

Since the mucosa alone is insufficient for a complete detailed study, recourse was had to the literature for the condition of the myometrium. The advent of radium has eliminated hysterectomy so that pathologic material is scant. Although many studies include the menopause type and are not strictly applicable, yet these findings are of interest.

Theilhaber and Meyer describe fibrous hyperplasia with muscle replacement so that control of the blood vessels by the latter is lost. This is assumed as the cause of bleeding. Reinicke has noted atheromatous changes in the blood vessels. More recently William Fletcher Shaw<sup>1</sup> has divided the uteri of chronic metritis into two groups: (1) Subinvolution; (2) Hypertrophy. In both of these glandular hyperplasia occurs, with additional changes throughout the uterine wall. To the subinvolution group belong the uteri of multipara with menopausal hemorrhage. Expanding Goodall's<sup>2</sup> studies of involution of the puerperal uterus, Shaw emphasizes the persistence of the elastic intima of the old vessels during puerperal involution; and normally, scant trace is left of the old intima. This persisting elastic tissue interferes with contraction of the muscle wall of the new vessels. In addition there is increased fibrous and elastic tissue throughout the myometrium. A personal study of many uteri of women dying of extrapelvic disease in the fourth decade would indicate these changes as incidental rather than causative, for no bleeding was present. The hypertrophic group includes uteri of virgins and nullipara. The majority suffer from menorrhagia and dysmenorrhea from puberty with a gradual increase in severity. "The endometrium shows a marked increase in gland and stroma as the

primary event. This is followed by a work hypertrophy of the myometrium causing an enlargement of the organ. The ratio of muscle to fibrous tissue remains normal." His microphotographic reproductions of sections stained by the Weigert-van Gieson methods are very interesting.

An older study by Pankow<sup>3</sup> contradicts these findings. This author studied 52 uteri removed for bleeding, using for control uteri removed for prolapse, without history of hemorrhage. Uteri of two virgins and one nullipara are included. Gross comparison and careful study of sections following the Weigert-van Gieson stain failed to reveal any essential difference in the myometrium of both groups, though hyperplastic endometrium was often encountered in the bleeding parous uteri. Yet, the control group is open to question, for passive congestion which goes hand in hand with prolapse could induce similar pathologic changes and hence deductions need be carefully made. Kajii<sup>4</sup> also reports in bleeding uteri the ordinary structure of a multiparous uterus. Faced with this maze of contradiction one readily appreciates Aschoff's compromising term of metroendometritis. Yet it must be emphasized that all observers note endometrial hyperplasia, even after Hitschman and Adler<sup>5</sup> have differentiated the premenstrual mucosa from the true pathologic hyperplasias.

Ewing<sup>6</sup> in discussing adenomata and adenomatoid conditions notes such proliferative changes in the wake of the following factors: (1) prolonged irritation; (2) accentuated repair following trauma; (3) increased response to excessive physiologic function. Certainly in the puberty group, trauma inflammation and parity are excluded, leaving "response to excessive physiologic stimulation as the exciting factor." The ovary has long been known as the cause of the cyclic hypertrophy of the endometrium.

In 1906 Hitschman and Adler first demonstrated the cyclic changes in the uterine mucosa. Subsequently these were formulated with the stages in maturation of the graafian follicle, ovulation and corpus luteum formation. The details need not be given. For our purposes it suffices to note that beginning enlargement of uterine glands coincides with ripening of the follicle, proceeding at a greater momentum with the formation of the corpus luteum and reaching the "pregnoid" state at the height of development of the corpus. Death of the ovum is followed by involution of the lutein body and in turn by "desquamation of the pregnoid endometrium or menstruation. During development of the corpus luteum ripening of other follicles is inhibited.

Correlation between ovary and glandular hyperplasia of the uterus has been shown experimentally. Lauth<sup>7</sup> has produced in animals the pathologic changes of "metroendometritis" by injection of ovarian extract. Schiller<sup>8</sup> in sexually premature rabbits produced the condition of heat with its associated hypertrophy and hyperemia of the uterus, by injections of corpus luteum. More recently Frank and Gustavson,<sup>9</sup> using the fatty residue from follicular fluid, corpus luteum and placenta, caused hyperplasia and hyperemia of the müllerian tract and mammae. In virgin immature rabbits and guinea pigs extracts from follicular fluid cause hyperplasia of the uterus, vagina, and breasts. The "female sex hormone" has been isolated from the blood of the sow and shown present in greater quantity during estrum. Allen, Pratt, and Doisy,<sup>10</sup> using liquor from human ovaries obtained by operation, have produced functional hyperplasia in rats, as shown by the vaginal spread test. Corpora lutea and placenta contained a similar hormone. From the functional standpoint similarity in function of follicle and corpus luteum must be greatly emphasized. Evans<sup>11</sup> has further shown prolongation of vaginal proliferation (indicative of estrum and hyperplasia) in rats, where the ovaries contained multiple ripening follicular cysts and absence of corpora lutea.

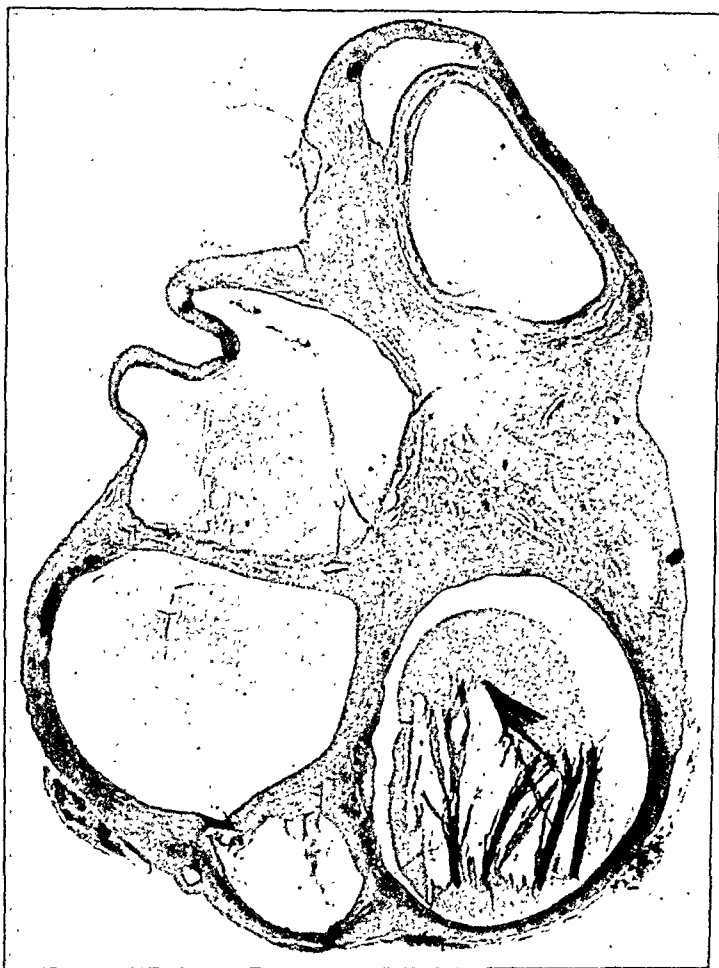


Fig. 8.—(Case 7.) Section transversely through the lower pole of the ovary. The organ is practically completely filled with follicular cysts.

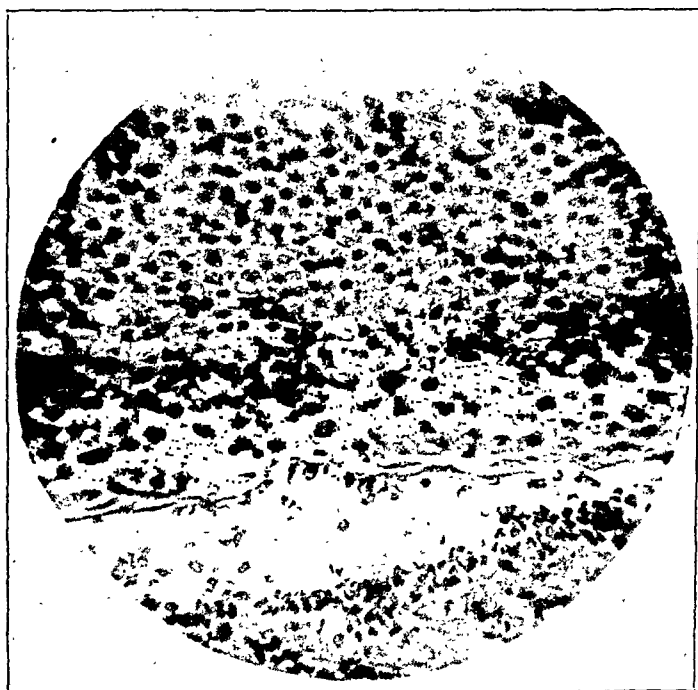


Fig. 9.—(Case 7.) Hypertrophic granulosa cells forming the lining of the follicular cysts noted in Fig. 8.

This is practically in accord with many observations on human ovaries.

Clinically Lauth<sup>7</sup> reports small cystic degeneration in one or both ovaries removed by panhysterectomy for bleeding. Franz<sup>12</sup> in an older publication notes follicular degeneration and ascribes the increased number of atresic follicles to fibrosis and reduction in the number of blood vessels. Similar findings are reported by Gottschalk, Winternitz and J. Veit. Kajii also emphasizes cystic follicles in the ovary. Cystic changes are recorded by S. H. Geist<sup>13</sup> in four multipara with "essential bleeding." Ludwig Adler<sup>14</sup> reports a case in a twenty-year-old virgin essentially similar to case 6 of our series. Uterus and adnexa were removed. Both ovaries were converted into numerous follicular cavities, no corpus luteum was present. Microscopically there were numerous cysts and atresic follicles varying greatly in their stage of ripening, and presenting a striking growth of granulosa cells. A corpus luteum was not found. Robert Meyer<sup>15</sup> recognizes a group of "cystically degenerated ovaries" associated with the history of bleeding and hypertrophy of the endometrium. These show several large follicles with normal or slightly proliferating cells, and also cysts in the regressive stage; at times lined by an unusually marked theca lutein layer. None of the follicles reach development but persist, even after death of ovum. Persistence of follicles causes a summation of stimuli to the uterine mucosa which is prolonged and constant. Corpus luteum formation is absent. Schroeder<sup>16</sup> reports similar findings but interprets the changes as due to persistence of multiple follicles ripening simultaneously, since inhibition is not exercised in the absence of corpus luteum. Novak and Martzloff,<sup>17</sup> however, report recent and functioning corpora in their studies in addition to large numbers of follicular cysts, and suggest this change for cases in which menorrhagia is the predominant clinical symptom.

In our series only one ovary is available for study (Case 7). Though allowing no deductions, it presents cystic changes as recorded by other observers. (Figs. 8 and 9.)

The organ is ovoid in form and measures 3 x 2.5 x 2.5 cm. Its anterior surface is clothed with fairly firm injected adhesions. The surface is lobular, due to the presence of numerous cysts, bulging beyond the cortex; these varying from 3 to 10 mm. in size. Most are translucent; the smaller ones, however, are bluish and hemorrhagic. Round yellow streaks, irregularly distributed, show remnants of involuting corpora lutea. On gross section the interior of the ovary is completely cystic. Narrow stromal strands separate multiple cysts. These vary from 5 to 12 mm. in size and fill cortex and medulla. Several are hemorrhagic or show zonal hemorrhage externally. Bleeding is present beneath the adhesions noted anteriorly.

Multiple sections of the ovary reveal similar structural changes. The germinal layer is poorly preserved. Vascular adhesions line the anterior surface. The tunica is sclerotic. Cortex is normal and holds exceedingly large numbers of primordial follicles. Moderate numbers show enlarged hydropic and degenerating ova. Others had just begun maturation when degeneration occurred, so that solid clusters of granulosa cells surround the dying ovum. In others liquor folliculi had appeared. The predominant change, however, lies in the numerous cysts. The majority retain the granulosa layer despite their size. In foci the layer is hypertrophic and 12 to 18 layers are present. In some cysts large areas present these changes. Subjacent lies a broad zone of large theca interna cells; a narrow layer of fibrous stroma separates the cell layers. In some follicular cysts granulosa cells have disappeared and only the theca cells persist. The vessels about the cysts are injected. In foci several have ruptured with zones of stromal hemorrhage: in many this has followed into the cavity. A few corpora albicantia are seen. These are large and fairly recent. A regressing corpus with shrunken fatty cells and pyknotic nuclei is also seen. Beneath the adhesions endometrial implants are seen. From a large



central cavity, secondary tubules are seen lying in typical endometrial stroma. The latter is filled with blood. Gland cells are tall, columnar, and ciliated. Hemorrhage into gland spaces has also occurred. The medulla of the ovary is largely occupied by cysts and shows no special changes from the normal. Blood vessels everywhere are numerous and congested. The hilum of the organ shows normal vessels.

In brief, the changes are typical, and the ovary has been converted into multiple cystic spaces lined by granulosa cells and containing large amounts of follicular fluid. The potency of this substance in production of proliferative changes has been demonstrated by Frank and Allen and Doisy. The continued and prolonged stimulation from the follicle is the necessary factor converting a temporary or functional hypertrophy of the endometrium to a pathologic of permanent hyperplasia.

#### MECHANISM OF BLEEDING

Physiologically menstruation begins with involution of the corpus luteum, and it has been believed that the function of the corpus is the inhibition of menstruation. Halban and Köhler's<sup>18</sup> experiments in humans, causing the onset of bleeding within two to four days after cautery destruction of the corpus luteum, support this viewpoint. Seitz and Wintz<sup>19</sup> have shown similar effects upon ovaries exposed to radium, in which ripening follicles and young corpora lutea were damaged. Only when the corpus was at the height of efflorescence, however, did bleeding follow, and the effect was essentially desquamation of a pregravid endometrium following involution of the corpus. If ovarian pathology in endometrial hyperplasia excludes formation of the corpus luteum, as believed by Meyer, Schroeder and Seitz, uterine bleeding cannot be directly inaugurated by the ovary.

The clinical symptom of bleeding, however, is accounted for by the vascular changes in the hyperplastic endometrium. Adler,<sup>14</sup> R. Meyer and R. Schroeder<sup>16</sup> have found thrombosis in the endometrial capillaries. The adjacent mucosa becomes necrotic and during the separation of the slough and resulting ulcer formation, bleeding proceeds from the site of demarcation. In the twenty-six cases reviewed, these thrombotic changes were found only on two occasions in the curettings examined and hence cannot be considered as the predominant mechanism. Seitz<sup>20</sup> notes and emphasizes the dilatation and elongation of the endometrial capillaries, so prominent a finding in these series. The engorgement is a pathologic accentuation of changes noted by Mauthner<sup>21</sup> in the capillaries of a premenstrual mucosa. In this phase the terminal capillaries which run vertically through the mucosa, to aberrate next to the glands, are constricted, while the connecting loops parallel to the surface are wide and tortuous. In the postmenstrual phase, the vertical branches are dilated and the horizontal branches narrow. The persisting hyperplastic endometrium of essential bleeding may be considered the pathologic analogue of the hypertrophic premenstrual mucosa. It is reasonable, therefore, to find the capillaries engorged near the surface, as is so well demonstrated in the microphotographs. According to Seitz these rupture readily following mechanical insult. This is concomitant with many active body movements and changes of intraabdominal pressure, as coughing, sneezing, vomiting, etc. Severity of bleeding will depend upon the size and number of the vessels affected.

In sixteen of the curettings examined focal interstitial hemorrhage was present. In ten, this was marked and formed a compact zone beneath an atrophic and compressed surface epithelium, as shown in microphotograph. Separation of the necrotic area of surface epithelium and stroma reopens the congested vessels and permits free bleeding into the uterine cavity.

### CONCLUSIONS

1. Puberty hemorrhage is a definite clinical entity presenting as a menorrhagia or metrorrhagia in the absence of inflammation, neoplasia or the pregnant state.

2. The soft patulous cervix is pathognomonic; the body may or not be enlarged.

3. Symptoms recur after curettage but are always controlled by radium.

4. Curettings are abundant, thickened and frequently polypoid. This is the result of a diffuse glandular, stromal and vascular hyperplasia.

5. Persistence of solitary ripening follicles or simultaneous maturation of multiple follicles accentuates a physiologic endometrial hyperplasia into a pathologic type. These changes have been experimentally reproduced by Frank and others in laboratory animals.

6. Corpus luteum formation is absent.

7. The uterus is the direct seat of bleeding. It results from thrombosis of the endometrial vessels and ensuing necrobiosis; and from actual mechanical rupture of engorged capillaries.

8. The factors inaugurating persisting, follicular cysts in the ovary with its concomitant endometrial hyperplasia, remain a subject for future study.

In closing I extend thanks to Drs. James Ewing, E. S. L'Esperance and Archibald Murray for their many suggestions in the preparation of this paper, also to J. Dunn for his photographs.

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1530 PRESIDENT STREET.

## THE NORMAL AND PATHOLOGIC PHYSIOLOGY OF PREGNANCY\*

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**R**EPRODUCTION represents the maximum of physiologic function of woman and, therefore, necessarily calls for the maximum of functional activity of all maternal tissues and organs. I say of "all organs," firstly, because today we accept as evident truth that all organs functionate as a harmonious unit under the controlling influence of a superimposed regulatory mechanism, and secondly, because during pregnancy all maternal organ function in the last analysis seemingly accrues to the benefit of the fetus in utero.

From this broader viewpoint it can easily be seen how likely confusion and error will result, and probably have resulted, from a method of study of the physiology and pathology of pregnancy which heretofore, in a rather onesided manner, was mostly directed towards investigating the behavior of but one organ (kidney, liver, thyroid, etc.), or ascertaining the changes in one organ system (vegetative nervous, endocrine, circulatory, etc.), or which tried to discover the one likely pathogenic factor (cytotoxin, foreign protein, placental ferment, or end-products of fetal metabolism).

A definite failure with merely anatomic-histologic investigations necessarily created keener interest in the study of functional deviations. Again in this respect, failure with testing organ function solely

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by means of chemie analysis of excretions has led to the development of newer methods which endeavor to gauge organ function more reliably by the chemie study of the retained body fluids. Such chemie analytic investigations today make use of all the latest advances in biochemistry and the physico-chemistry of colloids. Writers begin to speak of the molecular biology of pregnancy (Schade,<sup>1</sup> Seitz<sup>2</sup>). Thus, e.g., the interesting fact has been revealed that during normal pregnancy the definite and always constant proportional relations of sodium, potassium, and calcium contents and with it the ion concentration of the blood are altered. This, indeed, is an important discovery since it proves that pregnancy actually results in a constitutional change but—in contrast with changes of this kind outside of pregnancy—without disturbing a state of perfect health. This fact in itself convincingly demonstrates that however profound such alterations in the chemie constitution, morphologic condition, or functional activity of certain body fluids, tissues and organs are, the equilibrium in general still is maintained—of course, only through propitious modification in the work of that superimposed regulatory mechanism which controls all individual organ function as well as harmonious organ interaction.

An appropriate conception of the physiology of pregnancy then is not directly dependent upon accurate information concerning morphologic, chemie, or functional alterations observed during normal pregnancy in this or that of the maternal organs but rather on the understanding of the underlying causes and of the presumably rational purpose of all these alterations.

#### RELATIONS OF THE PHYSIOLOGY OF PREGNANCY TO THE PHYSIOLOGY OF MENSTRUATION

Of the many general changes, commonly, if not regularly, seen in normal pregnant women, often at the very beginning of gestation, I shall first mention one group for which, in my belief, we must recognize cyclic ovarian activity as the one common underlying cause.

*Blood Pressure.*—While we cannot speak of a physiologic rise of blood pressure during pregnancy, a striking variability with occasional marked temporary rise is a practically constant symptom. Even persistent hypertonia can occasionally be observed in the absence of any of its known causes (Huessy,<sup>3</sup> Kehrer<sup>4</sup>). In view of the physiologically increased work of the heart, expressed in an increase of both the contraction volume and blood output per minute (Frey,<sup>5</sup> Weiss<sup>6</sup>) and in a greater amplitude of the pulse pressure (Slemons and Goldsborough<sup>7</sup>), the maintenance of the blood pressure, approximately at a normal level, is determined by changes in the tonus of the capillaries. Therefore, a more or less physiologic rise might be

caused by the common angiospastic states of the capillaries (Hinselmann<sup>8</sup>), due to alterations in the entire vegetative nervous system and especially the vasomotor system during pregnancy.

*Basal Metabolism.*—An increase of the basal metabolic rate is a characteristic phenomenon of pregnancy (Baer,<sup>9</sup> Cornell,<sup>10</sup> Harding,<sup>11</sup> Haselhorst and Plaut,<sup>12</sup> Huessy,<sup>3</sup> Klaften,<sup>13</sup> Knipping,<sup>14</sup> Root and Root,<sup>15</sup> Rowe, Alcott and Mortimer,<sup>16</sup> Sandiford and Wheeler<sup>17</sup>). This increase often manifests itself in a slight rise of temperature and in faster respiration (Huessy).

*Carbohydrate Metabolism.*—The reduction during pregnancy of the ability to assimilate carbohydrates and even starch, when taken in large doses—manifested in a glycosuria—is now well known (Ehrenfest<sup>18</sup>). This phenomenon evidences itself so early in pregnancy that various diagnostic tests of pregnancy have been based on this apparent sugar intolerance. The dependence of this metabolic alteration upon ovarian function is firmly established (Kuestner<sup>111</sup>).

*Protein Metabolism.*—Definite deviations from normal have been ascertained in the protein metabolism of pregnant women. Protein disintegration in the earlier stages of gestation is characterized by a reduction in the excretion of urea with a relatively high ammonia elimination in proportion to the total nitrogen. Also the amino-acids and polypeptides in the urine are increased (Falk, Hesky, and Zange-meister, quoted by Huessy). However, late in pregnancy, with the same nitrogen intake, less nitrogen and less urea are excreted on account of nitrogen retention (Hoffstroem, Slemons, Zuntz).

*Thyroid.*—Enlargement of the thyroid early in pregnancy, associated with increased thyroid function, is today a generally admitted fact.

*Vegetative Nervous System.*—There exists general agreement that during pregnancy the entire nervous system is in a state of increased irritability. In regard to alterations of the vegetative nervous system, writers disagree as to whether these changes express themselves more in the form of a vagotonia or a sympathicotonia (Louros<sup>19</sup>), but no doubt is left concerning the fact that such changes occur. They are necessary for a required change in blood distribution (Huessy) and are evident in the existing modification of metabolism (Seitz<sup>20</sup>), of endocrine function or of the secretory activity of many organs. Careful pharmacodynamic tests show, however, that it is unjustifiable to ascribe every mysterious or puzzling phenomenon of pregnancy simply to a vagotonia or a sympathicotonia (Peysér<sup>21</sup>).

*Respiration.*—The respiratory rate as a rule rises early in pregnancy and therefore this change cannot be due to a decrease in the vital capacity of the lungs, obviously so, because even late in pregnancy a change in the configuration of the thorax usually brings full

compensation for the elevation and restriction in the respiratory movements of the diaphragm (Kehrer<sup>4</sup>).

*Blood.*—Of the many and marked alterations in the blood of pregnant women I will mention in this connection only the following: Often a leucocytosis is encountered (Heyn,<sup>22</sup> Huessy, Kehrer) and changes noticed in the erythrocytes which indicate an hyperactivity of the hematopoietic system (Umber). A lowering of the carbon dioxide combining power has been almost universally recorded (Kilian and Sherwin,<sup>23</sup> Marrack and Boone,<sup>24</sup> Wesselow and Wyatt<sup>25</sup>). The fixed acidity of the blood is physiologically increased during pregnancy (Hasselbach and Gammeltoft, Rowe, Banks and Alcott,<sup>113</sup> Wieser,<sup>26</sup> Williamson<sup>27</sup>). However, it is important to realize that the characteristic tendency of pregnant women to acetonuria, especially in the presence of vomiting or with a reduction of the carbohydrate intake (Harding and Duncan), represents quite a different type of acidosis, though the one might be superimposed on the other or be even related to it (Cook<sup>28</sup>). The concentration of the acetone body contents of the blood is normally increased in pregnancy, markedly so in almost all types of so-called toxicosis (Bokelmann and Bock<sup>29</sup>). This disturbance of the acid base equilibrium possibly plays an important rôle in sudden shock or even death after obstetric operations (Williamson<sup>27</sup>). The recovery of such patients under appropriate treatment, when the combining power has dropped within or even below the so-called fatal zone, only demonstrates the remarkable effectiveness, also during pregnancy, of that automatic mechanism which controls the ion concentration of the blood.

The common occurrence of acetonuria probably is due to an inability to burn up all fat and, therefore, as in the diabetic patient, manifests itself promptly after reduction of the carbohydrate intake. This striking disorder of metabolism appears so early that it has been made the basis for a diagnostic test, useful within a week after non-appearance of the expected menstruation (Pritzi and Lichtmann<sup>30</sup>).

All investigators concur in the fact that during pregnancy a hydremia exists (Harding<sup>11</sup>), starting probably with the onset of pregnancy and certainly being well marked already in the third month (Plass and Bogert<sup>31</sup>).

The biochemic and functional alterations which I have so far mentioned are so commonly observed in pregnant women that rather generally they are thought to represent typical and characteristic changes caused by pregnancy itself. I believe that this view is untenable because they all, as I will presently show, have been found to be equally as common and typical in the premenstrual state.

Considering only extragenital phenomena which in normal healthy women are observed during the week preceding the menstrual flow,

I can mention the following: A rise in blood pressure (Amos<sup>32</sup>), often a slight rise in temperature and pulse rate (Hafkesbring and Collett,<sup>33</sup> Cullis, Oppenheimer and Ross-Johnson<sup>34</sup>), and increased metabolic rate (Labhardt and Huessy,<sup>35</sup> Lanz,<sup>112</sup> Snell, Ford and Rowntree,<sup>36</sup> Wakeham<sup>37</sup>), an alteration in the carbohydrate metabolism expressing itself in lowered sugar tolerance (Heilig,<sup>38</sup> Kuestner,<sup>39</sup> Umber,<sup>40</sup> and others), and increase of size and function of the thyroid gland (Weidemann), certain disorders of the vegetative nervous system manifesting themselves chiefly in the form of a vagotonia (Franke<sup>41</sup>), the latter expressing itself also in abnormal behavior of the gastrointestinal tract when studied roentgenologically after a barium meal (Ludlum and McDonald Ellis<sup>42</sup>). Periodic changes with menstruation in the sensibility of the secretory and vasomotor nerves have been ascertained by pharmacodynamic investigations of the vegetative system (Dahlmann<sup>43</sup>). Monthly variations in cardiovascular activity and respiratory rate have been recorded (Moore and Cooper<sup>44</sup>). Circulatory and structural alterations of the capillaries are not limited to the capillaries of the endometrium, as is proved, e.g., by reports of ecchymoses on both thighs (Hirschberg<sup>45</sup>) or of bloody secretion from both mammillae recurring regularly with each menstruation (Zadik<sup>115</sup>). We can speak today of characteristic alterations of the physicochemic constitution of the blood in relation to menstruation, pertaining to the number of erythrocytes (Gumprich) and leucocytes (Dirks, Hofstetter<sup>110</sup>), to carbon dioxide combining power (Kuestner), disturbance in the acid base balance (Weismann-Netter<sup>46</sup>), its water and salt contents (Heilig<sup>47</sup>) and even to its calcium concentration (Malamud<sup>48</sup>). During the seven days preceding menstruation, exactly as in early pregnancy, there exists a marked rise of the urinary ammonia coefficient, due to a rise of the total output of ammonia rather than to a decrease in the total output of urinary nitrogen (Bond<sup>49</sup>). Menstruation apparently increases the permeability of the meninges (Heilig and Hoff<sup>50</sup>), and this same change has been found in pregnant women (Benda<sup>51</sup>), a condition which might account for mental disturbances noticed at times in menstruating as well as in pregnant women. Most significant in its possible bearing on the complex and still little understood problem of toxemia of pregnancy, in my opinion, is the fact that a heretofore merely superstitious belief of the laity in menstrual toxins now has been placed on a firm scientific basis (Schick,<sup>52</sup> Macht and Lubin<sup>53</sup>), though it is possible that their evident inhibitory effect on yeast fermentation not necessarily proves the existence of a specific menotoxin since this effect might be due only to an excessive secretion during menstruation of such substances as cholin or creatinine (Polano and Dieti<sup>54</sup>). Of great interest in this connection must also

prove the observation that premenstrually the blood exhibits a marked increase of proteolytic ferments and that, therefore, at that time the blood often gives a weakly positive Abderhalden reaction (Kjaergaard<sup>55</sup>).

That such manifold and profound chemie and functional changes occur with menstruation should not be surprising. We look upon them today as essential and characteristic features of the physiology of menstruation. We admit as established fact that this cyclic wave during a woman's menstrual life, first suggested by Jacoby, of New York, in 1876, and two years later strongly supported by Goodman, of Louisville, actually exists. We know that these waves are the general manifestations of cyclic changes in ovarian activity, that each wave rapidly approaches its peak during the premenstrual week, then abruptly drops and remains at its lowest level in the intermenstruum.

This similarity, if not identity, of premenstrual systemic changes with those so far quoted as typically observed usually early in pregnancy, is striking and suggestive but as a matter of fact it is only something that we should expect as natural. All changes occurring regularly with the discharge of an ovum from a matured graafian follicle necessarily are entirely independent from the fact whether this discharged ovum later is fertilized or not. These changes, therefore, must be in evidence when fertilization has taken place and the fertilized ovum has reached the uterine cavity.

We thus conclude, first, that systemic changes noticeable at the beginning of pregnancy and identical with those of the premenstrual state are not caused by pregnancy itself but are dependent upon a certain phase of the ovulation process and are produced by ovarian hormones, and secondly, that, in accordance with our present views concerning menstruation, general systemic changes exactly like those in the uterus and breasts express the monthly preparation for impregnation.

#### CHANGES DUE TO ADAPTATION TO FETAL REQUIREMENTS

Unlike the corpus luteum of menstruation, however, that of pregnancy persists. Its hormonal influence during the progress of pregnancy is supported and finally continued by placental hormones which have been found chemically and physiologically identical with those of the corpus luteum (Herman, O. Frankl,<sup>56</sup> R. T. Frank). Therefore, with the onset of pregnancy, i.e., with the realization of the merely anticipated implantation of a fertilized ovum, the premenstrual changes of uterus, breasts, and almost all other organs will persist, but necessarily in an intensified or otherwise modified form. We might say that systemic changes, in the premenstrual state expressing solely certain *qualitative* requirements of pregnancy, later adapt themselves to actual *quantitative* needs.



A gradual, more or less complete, adaptation of certain biologic premenstrual changes to quantitative needs arising in the course of pregnancy can be easily demonstrated by a few examples.

The *hydremia* of pregnancy seemingly exists at the very beginning of pregnancy (Plass and Bogert<sup>31</sup>). It thus cannot be the result of disturbed renal function as often is claimed. More reasonably it can be looked upon as preparation for, and adaptation to, fetal needs, since within a comparatively short time his dry substance contents are lowered from 95 to 75 per cent (Wieser<sup>26</sup>). As another reserve supply for water needs created by pregnancy can be regarded the commonly present edema of pregnant women. Also very marked edema is seen in the absence of any renal disturbance (Eckelt, Vollhard). As a matter of fact all connective tissue, not only the subcutaneous, contains more fluid and to this is due the characteristic and advantageous softening of such structures as vagina or pelvic ligaments (Kehrer<sup>4</sup>). This characteristic readiness for the formation of hydropic conditions during pregnancy is generally acknowledged and expressed by different writers in such terms as "latent tissue hydrops" (H. Strauss), "preedema" (Widal), or "edema preparedness—*Oedembereitschaft*" (Zangemeister).

The *basal metabolic rate* rises with the progress of pregnancy until it amounts, near term, on an average to above 16 per cent (Klaften<sup>13</sup>). Marked rise occurs both in the total twenty-four hour calories and in the calories per unit of weight during the later months of pregnancy (Root and Root<sup>15</sup>). The total heat production late in gestation amounts finally to 25 per cent increase of total calories for each hour as compared with conditions ascertained before impregnation in the same individual. The energy production of unit mass of the mother's protoplasmatic tissue remains practically unchanged throughout the course of pregnancy, and the increase in the total heat production thus in the main is due to the increasing mass of fetal protoplasmatic tissues (Sandiford and Wheeler<sup>17</sup>). This readily explains why the actual increase of the metabolic rate is disproportionate and comparatively too high in comparison to the mother's weight increase. The fast growing fetus obviously has a higher metabolic rate than the mother. A total weight increase of the pregnant mother, amounting up to six weeks before term to only 14 per cent, is found associated with a 23 per cent rise in the metabolic rate (Root and Root<sup>15</sup>).

To provide the required 35 to 40 additional calories per kilogram bodyweight (Magnus-Levy), all metabolism has to be speeded up, and especially that of the carbohydrates, which represent by far the largest part of the total food intake. This speeding up of sugar assimilation accounts for the common glycosuria after the intake of large amounts of sugar as result of a protective lowering of the renal

threshold for sugar to prevent a hyperglycemia (Ehrenfest<sup>18</sup>). This phenomenon might be emphasized as a good example showing how a physiologic change of the premenstrual state as the result of its adaptation to quantitative needs of the fetus at least temporarily will give rise to a symptom which in every nonpregnant individual is indicative of a truly pathologic condition. The effort at adaptation, here like in other and especially in pathologic-physiologic conditions, actually results in a surplus of function.

On the other hand we find that such an evident effort at adaptation to increased demands, at least temporarily might prove insufficient, as often can be observed in relation to the *calcium metabolism* during pregnancy.

An initial typical increase of the calcium concentration of the blood is almost invariably followed late in pregnancy by a marked decrease (Krebs and Briggs,<sup>58</sup> Plass and Bogert,<sup>59</sup> and others). It is a well-known fact that in a normal, healthy individual the Na, Ka, Ca relations of the blood are fairly accurately maintained in the proportions of 100 : 2 : 2, but during pregnancy a shift occurs in favor of calcium (Seitz,<sup>60</sup> Schade<sup>1</sup>). The calcium needs of the fetus are known. The quantity daily retained by him amounts to more than 600 mg. (Widdows<sup>61</sup>). But a surplus of calcium is also deposited in the form of osteophytes, chiefly on the inner surface of the mother's cranium, or on the maternal surface of the placenta. We, therefore, can understand why at the moment of delivery the maternal blood always shows a markedly lower calcium concentration than the fetal blood (Hellmuth<sup>62</sup>).

If the calcium intake with the food is inadequate, or, as it is more likely, if parathyroid function is inadequate, a negative calcium balance will result. Recently much clinical and experimental evidence has been furnished to prove that there exist very intimate connections between the potassium and calcium concentration of the blood and various clinical pathologic conditions, especially derangements in the function of nervous and endocrine systems (Seitz,<sup>2</sup> Zondek<sup>63</sup>). It has been ascertained that the Chvostek facialis phenomenon, which in its marked form is accepted as a characteristic sign of tetany, to a slight degree can be elicited in about 75 per cent of all pregnant women (Kehrer). Intravenous injection of calcium stops in pregnant women typical attacks of true tetany (Kehrer). Calcium deficiency, rather than chemie changes in saliva, is today generally looked upon as the main cause for the frequent destruction of teeth by caries during pregnancy. All these facts support the view that during gestation the calcium metabolism, though evidently speeded up, at times still remains quantitatively insufficient for actual needs.

A similar occurrence is occasionally observed in the *blood* changes during pregnancy. An increase in juvenile types of erythrocytes and marked polymorphism (Zanfragoni, Soli, Varaldo and others quoted by Huessy), morphologic changes in the bone marrow, an increase in the size of the spleen (Berger), and other findings clearly express hyperactivity on the part of the entire hematopoietic system. A fall in hemoglobin, often noticed in early pregnancy, later as a rule disappears. At term the total blood volume is increased approximately by 15 per cent (Gueissaz and Wanner<sup>64</sup>), amounting to between 300 and 450 grams (Kaboth<sup>65</sup>). But during pregnancy hemolysis continues to a certain extent (pigmentation, iron needs of the fetus). A pathologic degree of red cell destruction, at times observed, has been ascribed more generally to toxic factors (Aubertin,<sup>109</sup> Oettingen,<sup>66</sup> Schneider<sup>67</sup>), or more specifically to an exaggerated hemolysis (Rowland<sup>68</sup>) due to insufficient development of antihemolytic bodies in the blood (Hofbauer<sup>69</sup>) or deficient cholesterol concentration (Benda<sup>70</sup>). Thus in some pregnant women a condition develops which resembles a pernicious anemia though it is not identical with this disease.

These few examples, to which others easily could be added, will suffice to demonstrate that certain biologic changes, observable during the premenstrual state, persist during pregnancy in a form which expresses their more or less perfect adjustment to definite fetal requirements.

Other adaptive changes are necessitated in the course of pregnancy by the passage of various substances from mother to fetus. In the main they consist in end-products of fetal metabolism thus imposing upon the mother the duty of their elimination or chemic destruction. The entrance of such chemically active substances, which act on the mother in some form of stimulation, now is an established fact. Only in this manner can be explained observations made, e.g., on the pyopagic Blazek sisters (Schauta) or in many experiments with artificial parabiosis by joining two female animals and controlling the effect of impregnation of the one on the other. The nonpregnant animal develops in genitalia and breasts as well as in hypophysis, adrenals or thyroid all those structural changes which are characteristic for pregnancy (Matsuyama,<sup>71</sup> Nissen,<sup>72</sup> Schmidt<sup>73</sup>). The assumption that an important rôle is played in the physiology and pathology of pregnancy by placental ferments (Hofbauer<sup>69</sup>) is based on strong evidence. The entrance of fetal hormones into the maternal organism cannot be any longer doubted since by newer tests it now is possible to ascertain the male sex of the fetus in utero by the presence of testicular hormonal substances in the maternal blood (Luettge and Mertz,<sup>74</sup> Sellheim,<sup>75</sup> Streck<sup>114</sup>).

Introduction of such substances, outside of carbon dioxide and

other waste products of fetal metabolism, necessarily will cause reactive changes in the mother. Many writers insist of late that, e.g., blood changes in pregnant women do not express a merely negative defense reaction but represent a definitely positive factor, that they manifest the accomplished adaptation to profound biochemic alterations and indicate the reestablishment of a temporarily disturbed equilibrium (Abderhalden, Guggenheimer, Sellheim<sup>76</sup>). This might be so, but unfortunately neither the older nor this newer definition and interpretation of such changes brings us nearer to the solution of that one most important problem in the physiology of pregnancy: Which one of these many biologic changes is due to the influence of this or that substance known to pass from fetus to mother? It seems obvious that we shall not be able to make any claim to a satisfactory understanding of the physiology of pregnancy as long as the answer to this particular question has not been supplied.

Therefore, we can only surmise in a general way that certain other biologic changes during pregnancy; not so far mentioned here, represent reactions or adaptation to stimuli coming from fetus or placenta.

There is a physiologic increase of the fibrinogen contents (Dienst, Kroesing,<sup>78</sup> Mueller,<sup>77</sup> Oettingen,<sup>79</sup> Wesselow and Wyatt<sup>25</sup>) and of the cholesterol concentration of the blood (Albrecht and Weltmann, Aschoff and Bucmaster, Kuerten,<sup>80</sup> Neumann and Herrmann<sup>81</sup>). Either of these conditions has been thought to explain another characteristic phenomenon of pregnancy, namely an increased speed of erythrocyte sedimentation, confirmed by all investigators (Baer and Reis,<sup>82</sup> Linzemeier,<sup>83</sup> Woehlich and Bohnen<sup>84</sup>). That these same changes, probably in some way connected with altered liver function, are also noticed in inflammatory processes is not surprising because they actually express only greatly accelerated metabolism which prevails in pregnancy as well as in inflammations. These last mentioned blood changes can serve as a good example of the direct association and mutual dependence on each other of a number of biochemic changes typically observed in pregnancy.

In a similar manner we can trace another series of phenomena, commonly noticed in pregnant women, as caused by the anomalous behavior of the vasomotor system which in turn is so closely related to changes of endocrine function and of the physicochemic condition of the blood (Seitz,<sup>20</sup> Zondek<sup>63</sup>). Angiospastic states in capillaries interfere with the flow of the blood through them, and secondarily this fact plays an important rôle in the known instability of the blood pressure and probably also in histologic-anatomic changes of parenchymatous organs (Hinselmann<sup>65</sup>).

If we, with Aschner, define the term "constitution" as implying

not alone the total of hereditary endowment of an individual (Mathes) but as including as well all the changes later brought about by external influences, we can state that pregnancy causes in woman a profound constitutional change. Since the pregnancy reactions in general imply an increase of the functional ability of the various organs, they are as a whole advantageous. Since many of these changes are permanent, the woman starts at her second pregnancy in a certain sense as another, biologically better equipped, individual, a fact fully supported by clinical experience.

#### FUNCTIONAL CHANGES CAUSED BY ALTERED TOPICAL RELATIONS OF ABDOMINAL ORGANS

Elevation of the diaphragm and interference with its respiratory movements late in pregnancy does not in itself impede gas exchange. Changes in the configuration of the thorax preserve the normal vital capacity of the lungs, of course, granted that the woman's thorax is not distorted by a congenital or acquired deformity.

Through elevation of the diaphragm the heart becomes dislocated, the apex finally being pushed two cm. to the left. The degree of this torsion is determined by the type both of the thorax and of the heart. In the type of heart, which is described by J. Bauer as arthritic, the displacement leads to a practically horizontal position of the heart. This turning causes a twisting particularly of the pulmonaris and this accounts for the physiologic systolic murmur commonly heard in the left second interspace, especially with patient sitting or standing up, when the dislocated heart also is pressed against the sternum.

Enlargement both of the total volume of blood and the area of its distribution calls during pregnancy for augmented work on the part of the heart. The mass of the heart becomes heavier, but since this increase, as pointed out by Jaschke, is only proportionate to the increase in body weight, it cannot be properly termed an hypertrophy. Electrocardiographic studies also seem to exclude an actual hypertrophy but indicate enlarged function by the fact that all the waves of all the leads in all postures are of a greater amplitude (Smith<sup>86</sup>). The heart takes care of the extra load by a faster rate of contractions, and by increase of the blood volume expelled with each contraction or within a minute (Frey,<sup>87</sup> Weiss<sup>8</sup>). It might be emphasized in this connection that recent studies on dogs have shown increase of cardiac output not only during pregnancy but also, though to slighter degree, during the estrus cycle (Stander, Duncan and Sisser<sup>88</sup>). Even hearts frankly diseased will often bear up remarkably well, since the ability for adequate adaptation to increased needs is solely dependent on the condition of the myocardium (Herrick,<sup>89</sup>

MacKenzie,<sup>90</sup> Prassulides<sup>91</sup>). The break in compensation during pregnancy, as a rule, is brought about by extracardiac factors, most often by renal complications or infections. Overstrain in athletically inclined women during pregnancy may produce a relative cardiac insufficiency closely bordering on the pathologic (Daly and Strouse<sup>92</sup>).

Venectasies are the result of mechanical factors combined with a constitutional deficiency. Pressure exerted by the pregnant uterus interferes with the return flow of the blood to such an extent that by a change from the horizontal to the vertical posture the amount of blood contained in the lower half of the body is almost doubled (Fick<sup>93</sup>). While in nongravid women the venous pressure in arms and legs is the same, even early in pregnancy the venous pressure in the lower extremities always is found higher than that in the ulnar veins (Runge<sup>94</sup>). The formation of venectasies through interference with the blood flow is directly dependent upon anomalies of the elastic tissue noticeable all through the body (Fischer<sup>95</sup>).

Pressure of the pregnant uterus against the ureter certainly plays only a minor rôle in the origin of the so-called pyelitis of pregnancy. Easy and effective drainage of the kidney in many instances is prevented by fairly common congenital ureteral strictures or due to kinks resulting from redundancy and folding of otherwise normal ureters (Eisendrath<sup>96</sup>). Varying degrees of dilatation in the upper urinary tract occur in up to 80 per cent of normal pregnant women (Jolly, Kretschmer and Heaney,<sup>97</sup> Strassmann<sup>98</sup>). This dilatation very likely often is not caused by any stricture or compression, but like atonic constipation in pregnant women is only the expression of disturbed function of the sympathetic nervous system (Stoeckel<sup>99</sup>). Pediatricians have found pyelitis to be a common disease of early childhood, and also among children the right ureter is the one most often affected. Pregnancy itself perhaps only very rarely represents the actual cause for a pyelitis but frequently acts as a predisposing factor, merely lightening up a preexisting condition (Kermanner,<sup>100</sup> Stoeckel,<sup>99</sup> Williams<sup>101</sup>). This view is strongly supported by the fact that a pyelitis often is observed to continue long after delivery, i.e., long after the assumed harmful compression of the ureter certainly has ceased (Rosinsky<sup>102</sup>).

#### OTHER ADAPTIVE CHANGES

Adaptation to the needs of the growing fetus is accomplished not solely by morphologic, chemic or functional changes of the mother.

The fetus is not a parasite in the common meaning of this term. He abstracts automatically from the maternal blood all the material he requires, and occasionally even to a degree not any longer compatible with the mother's health, but at the same time he always

acts also as a forceful stimulus on the mother. Under normal conditions during pregnancy her desire for food increases markedly. In a recent meeting of physiologists in Vienna (1925) the obvious difference between hunger and appetite was thoroughly discussed. It seems that while hunger like thirst in general simply implies the existing need for the intake of nourishment, appetite more specifically expresses the desire for special food substances. It is reasonable to expect that a careful analysis of the so-called longings of the pregnant woman will throw additional light on this particular problem of appetite. Frequently such longings precisely express a specific need of fetus or mother. In the light of facts mentioned in foregoing pages we might appreciate the rationality of the occasional craving for chalk, for sweets, acids or alkalis. In regard to the very common craving for acids I might emphasize that, in contrast to prevailing opinion, in the overwhelming majority of cases during pregnancy the gastric secretions show a state of subnormal acidity while hyperchlorhydria actually is rare (Kehrer,<sup>4</sup> Krahmer-Petersen<sup>103</sup>). Of course, this does not preclude the possibility that at times such longings are truly perverted, or that the intake of specific food material is insufficient as the result of external conditions or of ignorance. There still remains a field for intelligent food supervision in prenatal care.

Adaptation to fetal needs, however, is accomplished not only by greater food intake but also by its better metabolization and by restriction of its utilization for the mother herself. This latter factor more recently has been studied by Russian physiologists (Reprieff<sup>104</sup>). Some of the chemical changes in body fluids indicate better metabolization. The common desire of gravid women for inactivity, their longing for rest and sleep may be but the expression of an automatic restriction in the utilization of food for their personal needs.

#### PATHOLOGIC PHYSIOLOGY OF PREGNANCY

While admittedly lying within the boundaries of physiologic normalcy some of these structural, chemical and functional changes incident to pregnancy, as already pointed out, often are accompanied by clinical manifestations which in the nonpregnant individual always—and even in the pregnant woman at times—are indicative of a truly pathologic condition.

Not directly concerned in this paper with the relation of pregnancy to the origin of disease, I shall consider here only those symptoms in the pathophysiology of gestation which merely suggest disease. Many recent investigators have endeavored to establish the etiology of such pathologic states and to discover the specific cause for each of them. In view of our undeniable ignorance concerning

the specific physiologic reaction to a specific stimulus in normal pregnancy it seems surprising that most investigators make it their task to reveal the nature and degree of abnormal reactions both to normal physiologic and clearly pathologic stimuli, and that they have selected as the favorite field for their researches the so-called toxemias of pregnancy.

That laborious studies along these lines so far have failed to yield conclusive results, in my opinion, is due to several causes. First of all, too exclusively the growing ovum has been looked upon as the only possible source of all the changes observed in a pregnant woman. Our present knowledge that a large group of phenomena of pregnancy, including the presence of toxic substances and of proteolytic ferments in the blood, can also be observed during the premenstrual state, clearly forces us to include dysfunction of the ovaries as a possible other direct or indirect cause of disturbances which manifest themselves early in pregnancy, as is the rule with the so-called toxemias. And secondly, there actually does not exist agreement concerning the very term "toxemia." To those authorities who at present differentiate specific types of toxicoses, we find strenuously opposed others who with equal justification regard toxemia as a sort of entity which expresses itself under a variety of clinical pictures. The term toxemia seemingly has arisen from the wide distribution of the various lesions found in these cases and from the fact that concurrent structural changes are of a degenerative rather than of an inflammatory character (Wesselow and Wyatt<sup>25</sup>).

In this problem, in my opinion, not sufficient consideration is accorded to still another characteristic common to so-called toxemias. Their clinical manifestations disappear either during pregnancy or soon after its termination. Often it is this characteristic alone that enables us to recognize in the individual case a pathologic state as a toxicosis, and to differentiate it from a truly pathologic condition which also may manifest itself first during pregnancy but will persist after the expulsion of the fetus. A supposedly harmless toxic nephropathy of pregnancy in a considerable percentage of cases reveals itself a year or more later as a true nephritis (Baisch, Harris,<sup>105</sup> Zangemeister, Zondek and Jakobovitz<sup>106</sup>).

We might then with more justification state that pathologic-physiologic manifestations during pregnancy, and especially those commonly but incorrectly ascribed to a toxic state of the blood, primarily express only the inability of the maternal organism to adjust itself promptly or completely to the various exigencies imposed on it by pregnancy. Very often this deficiency of perfect adaptation is caused by a failure on the part of but one organ or organ system, and in this



manner we can plausibly account for the variety of clinical pictures. Organs prematurely arrested in their postfetal development or slightly damaged by preceding disease may be unable to augment their function to the required degree, especially during the first pregnancy. As the result of further structural change incident to pregnancy they may completely break down in function.

Inadequate response to needs must not by any means give rise to the accumulation of toxic substances in the blood. The pituitary gland is an important member of the endocrine system. With changed ovarian function during pregnancy it undergoes marked and well-known morphologic and functional changes. The pituitary exerts its influence on such widely differing processes as tissue growth, carbohydrate metabolism or water distribution in the body. An incongruous reaction of this gland during pregnancy then might play a part in the causation of such pathologic signs as swelling of the face or hands, of glycosuria or the formation of edema, phenomena which under these conditions certainly would not be due to a toxemic state.

Recent investigators seem to have established a direct connection between the general habitus of the woman or her nervous-emotional make-up to some of the presumably toxemic disturbances of pregnancy. H. Strauss<sup>57</sup> speaks of a special disposition to albuminuria existing in women of an asthenic habitus. Draper<sup>107</sup> ascertains that larger, heavier built women of masculine type, who in general display the insignia of previously increased pituitary function, are prone to develop under the stimulus of pregnancy hypertension or nephritis, a fact which suggests that idiopathic hypertension and nephritis possibly are but different expressions of the same disease. Various writers assert that the severe type of hyperemesis is met only in highly emotional women. Chemical studies, especially of early cases of hyperemesis, manifest the signs rather of inanition than of a toxemia. This inanition is primarily caused by idiopathic and psychogenic factors leading to anorexia, nausea and actual vomiting (Frey<sup>108</sup>).

It will be superfluous to quote examples or cite authorities for the assertion that a previously damaged organ may during pregnancy be further or permanently impaired as the result of added structural changes or under the strain of greatly increased function.

Evidences of inadequate adaptation in form of pathologic clinical symptoms are common within the first trimester. They might persist up to the termination of gestation, but the usually early restoration of the disturbed equilibrium, chiefly through the influence of that superimposed mechanism which controls harmonious organ interaction, is one of the outstanding characteristics of the normal and pathologic physiology of pregnancy.

## CONCLUSIONS

During the week preceding the menstrual flow ovarian hormones initiate profound biologic changes not only in the genitalia but throughout the organism, which definitely manifest the consistent and propitious preparation of woman for impregnation. They necessarily are in evidence at the moment of the implantation of a fertilized ovum. It, therefore, is unjustifiable to explain any of these biologic changes as due to some foreign protein, cytolsin or any other factor dependent upon the implantation process. They are due alone to ovarian hormones.

Changes, primarily the result of cyclic ovarian function, during pregnancy are modified, and others added as gestation progresses.

The widespread and varying morphologic, chemical and functional alterations, which characterize the normal physiology of pregnancy, express the gradual adaptation to exigencies created by pregnancy. These requirements consist chiefly in qualitative and quantitative needs of the fetus for building materials and energy, and for adequate disposal of end-products of fetal metabolism and of other chemically active substances passing from fetus to mother. Later in pregnancy adjustment is required to certain toxic derangements within the abdominal cavity caused by the enlarging fetus and uterine tumor.

In the constitutionally normal and healthy woman this necessary adaptation will be fully achieved. She will continue during pregnancy in a state of health.

In the woman who is constitutionally deficient, or in whom certain organs or organ systems through premature arrest of postfetal development or through preceding disease have become unable to respond with an increase of function to an increase of demands, adjustment is likely to be accomplished only slowly or imperfectly. Inadequate adjustment manifests itself in symptoms and clinical findings which in the nonpregnant individual always indicate a truly pathologic condition. They constitute the pathologic-physiology of pregnancy, best and most often expressed in clinical pictures commonly described as the toxemias of pregnancy.

Additional structural changes during pregnancy and the strain of greatly increased functional activity may impair an already injured organ to such an extent that complete restitution later becomes impossible. This transition of pathologic-physiologic changes into actually pathologic conditions, this transgression over the always indistinct borderline between merely temporary disturbance and true disease, as a rule is gradual. Often the fact that this change actually has occurred cannot be established until some time after pregnancy has ended.

Pregnant women, better and more conveniently than sick individ-

uals or animals in laboratory experiments, offer most favorable opportunities for following step by step the development of structural and functional derangements in all the larger parenchymatous organs and especially the endocrine glands, and for observing in their incipience certain disturbances of general or special metabolisms. A clearer understanding of the specific stimuli and conditions which during pregnancy lead to all these marked alterations could not fail to enlighten us also concerning the primary causes of various diseases or concerning those specific conditions under which slight impairment of one kind or another is likely to develop into actual disease.

The assumption seems justified that, with further addition to our knowledge concerning the general biologic effect of cyclic ovarian activity, a careful analysis of the premenstrual reactions of the individual woman might enable us to predict with some certainty how, at some later date, she is likely to adjust herself to the demands made by a pregnancy.

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METROPOLITAN BUILDING.

(For discussion see page 126.)

## STERILITY ASSOCIATED WITH HABITUAL AMENORRHEA RELIEVED BY X-RAY THERAPY\*

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### I

AMENORRHEA associated with sterility is not uncommon. I have encountered it 74 times in a series of 1,450 consecutive cases of sterility. As a rule it renders the prognosis less favorable. Any measure which restores the menstrual function necessarily improves the prognosis, for the cause of the menstrual abnormality, other things being accounted for, may also be responsible for the sterility.

Cases of spontaneous cure are occasionally encountered, and pregnancy occurs when it is least expected. Three out of a total of 54 cases of sterility associated with amenorrhea and oligomenorrhea came under my personal observation between December 4, 1923, and December 31, 1925. They serve as a basis of comparison with the incidence of pregnancy occurring during this same period of time in twelve similar cases that were subjected to mild x-ray treatment. When pregnancy occurs spontaneously in these cases, the patient may regard herself in one of the phases of amenorrhea to which she has become habituated, and subjective symptoms such as nausea or vomiting may not lead her to suspect the true condition. In such cases the last ovulation following the last menstruation contributes the ovum which has become successfully fertilized.

The sterile patient complaining of amenorrhea must necessarily be less susceptible to conception than one whose menses are in all respects regular. For example, a woman who has a menstrual period

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twice a year has only one-sixth the normal number of ova available for impregnation. The presence or absence of the menstrual phenomenon is from all the evidence so far obtained, and until some other reliable method be developed, a fair indication of the functional activity of the ovaries. It is obvious that by increasing the number of a patient's menstrual periods, or better, the corresponding number of ovulations, that we shall improve proportionately her chances for impregnation.

Many measures have been tried from time to time to regulate the menses with varying results, too often based upon empirical grounds rather than upon scientific evidence. The most successful, perhaps, have been the gland extracts. The happy results, sometimes brilliant, in the experience of many have, however, been incapable of repetition in the same hands or in those of others. For this failure to get uniform results in the treatment of sterility associated with amenorrhea, our lack of knowledge of the relationship between cause and effect has been chiefly responsible. Another important reason is the fact that gland extracts have been prepared according to different methods and vary widely, with the exception of thyroid and adrenalin, in their chemical structure and pharmacologic action.

Through the therapeutic use of the x-ray in the treatment of female genital bleeding a better understanding of one phase at least, of the relationship between ovarian function and uterine function has been reached. When uterine bleeding due to fibromyomata was treated by fractional x-ray doses, it was common experience to find that the first or second menstrual period would be increased and that a cumulative result was obtained after several treatments with the x-ray, the bleeding gradually diminishing and finally ceasing altogether. The effect of the x-ray is, as is well known, principally upon the ovaries and secondarily upon the uterus. We may, therefore, assume that mild doses induce certain changes in the ovaries which are expressed by increased uterine bleeding, while severe doses of the x-ray manifest themselves eventually by the disappearance of uterine bleeding. Apparently there is a quantitative as well as a qualitative relationship between x-ray dosage on the one hand and changes in ovarian structure and function on the other.

I shall not enter into the theoretical discussion of the so-called "stimulating" effects of the x-ray in contradistinction to the term "irritation," as we understand it in pathology. The biologic evidence is too scant to enable us to speak with precision on this point. Whether or not every application of deep rays first induces a certain degree of cell destruction or whether it simply stimulates the cells or organs, or the whole organism to increased function or growth, it is impossible as yet to determine. Certain secondary effects of ir-

radiation appear to be specific, as, for example, the increase in the coagulability of the blood and the formation of connective tissue observed so commonly in carcinoma therapy. It is difficult, nevertheless, to be certain that there may not have been a primary cell destruction to which these effects were secondary.

Geller's experimental work dealing with the question of the stimulating effects of the x-ray is suggestive but not yet conclusive. He found that irradiation of the ovaries of rabbits and rats with 5 per cent of the human skin erythema dose was followed by no ascertainable histologic effects in the excised ovaries. Ten per cent of the skin erythema dose, however, induced a definite diminution in the primary follicles which also showed degenerative changes. He therefore concluded that the *histologic changes passed at once from inaction to destruction*. When 20 per cent or 30 per cent were used the destructive effects upon the ovary were noticeable in the first weeks following the irradiation. A great many ripening follicles were still present but most of them showed signs of degeneration. These results incidentally contradict the accepted notion that the x-ray exerts a different influence on the different types of follicles, because the primary follicles and the larger follicles are equally affected. Whether or not these results obtained in the rabbits and rats can be assumed for the human is naturally problematic.

Inasmuch as amenorrhea was generally held to be due to an underfunction of the ovaries, Van der Velde began in 1915 to treat amenorrhea and oligomenorrhea by irradiation of the ovaries. His work was followed chiefly by Flatau and Thaler who used small doses of the x-ray in the treatment of amenorrhea. Flatau irradiated with a single x-ray dose equivalent to  $\frac{1}{3}$  of the castration dose. He treated 38 cases and found that in 25, the menstruation set in normally in the course of three to six weeks. In 12 more cases by treating only one field with a larger focal distance (30 cm. instead of 23 cm.) from the back, in order to embrace and affect surrounding tissues, vessels and nerves in the irradiation zone, 10 were cured; four cases out of his series became pregnant.

A still larger series of cases is reported by Thaler who treated all sorts of menstrual disturbances by weak doses of the x-ray. He uses milder doses than Flatau. One hundred forty-seven cases were irradiated by him. Of 62 cases of primary and secondary amenorrhea, 40 were cured. In 32 cases with too frequent menstruation due to an underfunction of the ovaries, 11 resulted in the return of regular periods. Out of 18 cases with abnormally long intervals and abnormally weak periods, 12 resulted satisfactorily. *Five women out of 80 with amenorrhea and oligomenorrhea became pregnant in the first month following the treatment.*

These results according to Martius<sup>1</sup> have been confirmed by Recasens, L. Seitz, Mansfeld, C. Schonhof, Meiner, Groedel and others. Wieloch appears to be the only one who feels that the treatment is a very uncertain one. A. J. Rongy<sup>2</sup> reports 13 cases treated by I. S. Hirsch with "stimulating" doses of x-ray, in five of whom the menstrual function was reestablished.

Mansfeld reported three cases of pregnancy following x-ray treatment of hypomenorrhea; Meiner and Aaron, one case; Kaufman, one case, and Kraul, one case. Linzenmeyer and Thaler have reported pregnancies following weak irradiation of the ovaries in cases with increased menstrual periods (polymenorrhea).

#### THEORIES OF MANNER IN WHICH THE X-RAYS INFLUENCE THE OVARIES AND RESTORE THE MENSES IN AMENORRHEIC CASES

Flatau thought that the x-ray exercises a simple functional irritation upon the underfunctioning ovaries. Thaler, however, felt that the process was more complicated and that the corpus luteum which often persists in cases of amenorrhea undergoes a regressive change through the action of the x-ray. He further advanced the theory that the nonspecific protein bodies which result from the breaking down of the irradiated areas may also be responsible for the changes in the menstrual periodicity. This notion has since found support in the analogous results induced by protein bodies and the x-ray upon the metabolism of water, mineral and the hydrogen-ion concentration of the blood as found by Chr. Kroetz of Greifswald and later Anderson of Kiel.

The secondary effect of weak x-ray doses upon the fetus was studied by Martius and Franken. Six white mice of different strains were subjected to weak doses of the x-ray. The animals were selected after determining their mating and litter-dropping capacity. Eight days later five female mice were mated with five males of a foreign blood strain. All of these with the exception of one pair bore young after 21 to 25 days. The given dose was not sufficient to cause temporary sterilization. The number of young, however, was strikingly diminished for each pair. Whereas formerly they bore four to nine young, the number was now two to four, in other words a reduction of fertility to less than one-half. The mortality of the offspring was extraordinarily high. They also exhibited retarded growth; their skin was coarse and the hair on the head, as well as on the back, especially between the shoulder blades, was thin and scrubby. The animals looked thin and miserable and after six months weighed 16-18 grams instead of 23-25 grams. Younger animals similarly treated failed to become pregnant after six months. Martius concluded that there is always a certain amount of destruction of germinal substance



induced by "irritation" x-ray therapy. But these effects produced by animal experiments do not hold for the human being. So far not a single instance of a malformed fetus has been reported following x-ray treatment for myopathic conditions. Because of Geller's experimental results and his own work, Martius recommends careful x-ray dosage in the obstinate cases of amenorrhea as a last resort only. In cases of oligomenorrhea, as well as polymenorrhea, he feels that instead of a normal return of the menses there may ensue an actual permanent termination (premature climacterium). Seven out of thirty-two women in Thaler's series who were irradiated for polymenorrhea became amenorrheic.

H. B. Mathews<sup>3</sup> investigated the effects of radium rays upon ovarian tissue. He found that after exposure of the ovaries to from 600 to 800 mg. hr. pregnancy can and does occur, but doses above these figures cause sterility. Young healthy ovaries would stand much larger doses of radiation than older and less active ones.

The effect upon a fetus in utero by the irradiation is, however, different. Harold Bailey<sup>4</sup> concludes from his study of the literature and his own personal experience that in the treatment of menorrhagia in the childbearing period complete sterility is preferable to the possibility of a damaged germ plasm. He questions whether radium or x-ray irradiation should be used to destroy the ripe follicles, leaving the immature ones injured but capable of development. He makes this statement entirely upon the strength of the experimental work on lower animals but does not feel justified in considering any of the available clinical records as adding conclusive evidence in this regard. His further conclusion is that irradiation of the ovum during early gravidity should never be permitted. "Radiation in late pregnancy while it may not produce gross abnormalities at birth may hinder the growth and development of the child in later life."

So constant is the lethal result upon the young embryo that abortion or premature labor is very common, and this fact has been utilized in the induction of abortion in certain cases of pulmonary tuberculosis complicated by pregnancy. Where the pregnancy goes on to term the child exhibits abnormality in more than 90 per cent of the cases; so certainly that Seitz regards it a matter of urgent necessity to induce abortion in every case where abortion does not set in spontaneously in cases subjected to castration or carcinoma dose of the x-ray.

From Mathew's questionnaire including 874 cases of radiated women in childbearing age collected from all parts of the United States, 39 pregnancies occurred. From these 39 pregnancies 20 full-term normal babies were delivered. There were 15 abortions or miscarriages and three premature labors, making the ratio of abortions to normal labors 1 to 2.6, whereas in Germany the ratio is as 1 to 2.3

in 1,512 cases. The estimated ratio of abortions to normal pregnancies in the United States is as 1 to 3 or 4, whereas in Germany it is as 1 to 5 or 6. Only one patient in my series out of nine who became pregnant aborted. This patient aborted twice in succession.

If x-ray therapy is to be adopted in the treatment of sterility associated with amenorrhea it becomes a matter of great importance to determine what type of cases may be benefited and what type of cases may perhaps suffer still further loss of function. Martius summarized his conclusions on this point as follows:

1. The ovarian insufficiency may be due to a primary numerical deficiency in functioning follicles. In this case mild doses of the x-ray may do no good. They may even cause damage.

2. In a milder degree of ovarian insufficiency the amenorrhea or oligomenorrhea may be due to the fact that the follicles do not mature properly. Consequently there is no corpus luteum formation. Because of the absence of the inhibitory control of the corpus luteum the follicles ripen in excess and never or very seldom reach full maturity. As a result of this excessive immature ripening and cystic atresia of follicles the ovary becomes the seat of the so-called small cystic degeneration. Should mild doses of the x-ray be used then these immature follicles designated by Borak as "inadequate" become destroyed and in their place properly maturing follicles which may develop to the point of corpus luteum formation can ripen every four weeks and thus give rise to regular menstruation.

R. Schroeder advances the theory that the premature death of the ovum induces a premature regression of the corpus luteum. With the inhibitory control of the latter lacking, follicles may begin to ripen excessively and induce polymenorrhea. Through the action of the x-ray which affects all sorts of follicles, the intervals between full maturation of individual follicles may become greater, and amenorrhea results even without the intervention of a corpus luteum. There is thus a definite loss in parenchymal ovular structures, a result which can also be obtained, as first reported by Pape, when only one ovary is irradiated.

The dosage of x-ray now generally employed is practically the same as that recommended by Borak and is as follows:

For amenorrhea, 5-10 per cent of the skin erythema dose.

For oligomenorrhea, 10-15 per cent of the skin erythema dose.

In cases of bleeding, when it is desirable to reduce the flow, 15-35 per cent of the skin erythema dose is given.

When it is desirable to sterilize the patient, 25-50 per cent of the skin erythema dose is given.

A great deal depends upon the age of the patient, the apparatus used and the dosage necessary to produce a skin erythema. Martius believes with Borak in the preferable one-sided castration in cases of metrorrhagia in women younger than forty instead of bilateral irradiation.

## II.

The present report deals with 12 cases of sterility associated with amenorrhea or oligomenorrhea of milder and severer degree; nine of these patients have become pregnant following the use of mild

doses of the x-ray, the remaining three have so far not become pregnant. In the light of animal experimentation and reported clinical cases in medical literature, they should prove of some value.

CASE 1.—H. S., thirty-two years old, married twice; first marriage was fourteen years before, the second marriage was six years before. Menses began at thirteen years of age, always irregular every three to four to six months. Her last menstrual period was December, 1922. Uterine insufflation was done March 16, 1923, and her tubes proved to be patent. Both adnexa were enlarged and prolapsed, the left larger than the right. March 16, 1923, she was given thyroid extract and ovarian residue. April 5, 1923, the same things were prescribed. These failed to bring on the periods. December 5, 1923,  $\frac{1}{40}$  skin erythema dose (Dr. Charles Gottlieb). December 16, 1923, again  $\frac{1}{40}$  skin erythema dose. After an amenorrhea of twelve months she started to menstruate December 20 lasting to the 30th, very profusely and passed one clot. On examination the adnexa were found to be definitely reduced in size. There were no periods between December, 1923, and March, 1924, when she was examined and the uterus was found to be enlarged to the size of a two months' gravidity. Quickening was felt May 12, 1924. October 7, 1924, cesarean delivery at the Woman's Hospital of a boy weighing seven and a half pounds. One menstrual period postpartum, April 6 to 10, and, when last seen on January 18, 1926, there had been an amenorrhea for eight months, when examination showed that she was not pregnant.

CASE 2.—M. K., thirty years old, married eight years. Menses began at fifteen years, always irregular every three, four, six or twelve months, of six days' duration, and profuse. Her last menstrual period was December 1 to 5, 1923, and on examination both ovaries were found to be distinctly enlarged and one and a half times the normal size, prolapsed, and hard but not tender. January 15, 1924, uterine insufflation was done and her tubes were found patent. March 22, 1924, x-ray stimulation (Dr. Charles Gottlieb), thirty-two ma. minutes, 200,000 volts to the right ovary (8 x 4) and on May 27, 1924, thirty ma. minutes, 220,000 volts to sella turcica. Her next period was August 1 to 6, 1924. She flowed moderately the second and third days and scantily for three days; another menstrual period September 12 to 18, 1924. September 19, 1924, another uterine insufflation and tubes were found patent. The next period was October 18 to 24, 1924. March 21, 1925, the patient reported that there had been no bleeding since October and the uterus was found to be gravid two months. Quickening was felt July 1, 1925, and November 18, 1925, she was delivered of a male child weighing eight pounds and one and a quarter ounces. In this case no opotherapy was used.

CASE 3.—L. C., twenty-four years of age, married three years. Menses began at age of thirteen, very irregular, every three or four months; at the age of eighteen she had a period of amenorrhea lasting eight months. Her last menstrual period was July 4, 1923. On examination January 23, 1924, both adnexa were found to be prolapsed and there was a definite cystic enlargement of the ovaries. January 30, 1924, she was given thyroid and ovarian residue. February 26, 1924, uterine insufflation was done, and the tubes were found patent. She stained February 28 until March 2 following the insufflation. March 6, 1924, x-ray stimulation after an amenorrhea of eight months, by Dr. Charles Gottlieb, and again on April 4, 1924, twenty-eight ma. minutes, 220,000 volts to the region of sella on each side. The period after the x-ray treatment was July 6 to 13 and again July 28 to August 1, 1924. September 24, 1924, the uterus was found to be enlarged to the size of a six weeks' gravidity and there was no bleeding since August 1. She stained October

6 after a fright. December 21, 1924, she felt quickening, and on December 28, 1924, an approximately five months' female fetus which was perfectly formed, was aborted. May 28, 1925, she reported her last period was February 22 to 25 and four weeks later she stained for four days and then two weeks later again stained. First week of April she stained for three days. July 23, 1925, she reported her last period as May 12 to 18, 1925. August 20, 1925, the uterus was found to be definitely enlarged to the size of a two months' gravidity. Quickening was felt October 16, 1925. December 3, 1925, a six months' male fetus, which was perfectly formed, was aborted.

CASE 4.—A. S., nineteen years of age, married one year. Menses began at seventeen years, duration six to seven days. She had two periods in two years. February 2, 1922, on examination the uterus was found to be small, the adnexa not palpable. Her last period was five months before. She was given thyroid and lutein. February 23, 1922, she was given pituitary and ovarian residue, and her period started February 24 until March 4, after six months of amenorrhea. May 31, 1922, she was again given ovarian residue. From October 10 to 21, 1922, she received injections of pituitrin. Her next period started October 27 and lasted until November 4, 1922, after a period of amenorrhea of seven months' duration. She had another period November 26 for one day. December 19, 1922, uterine insufflation was done and her tubes were found patent. Her next period was December 20 to 27, 1922. March 3, 1923, she reported no period since December, 1922, and was given thyroid tablets. She stained March 10 to 12 scantily after a period of two weeks' amenorrhea. Her next period was April 26 until May 6, 1923, and was very profuse; another period July 28 to August 4, 1923. After five months' amenorrhea the next period was March 1 to 5. X-ray treatment by Dr. Charles Gottlieb April 11, 1924, thirty ma. minutes, 220,000 volts to the right ovary. May 16, 1924, fifteen ma. minutes, right ovary, 220,000 volts, and 30 ma. minutes, left ovary, 220,000 volts and the next period was June 1 to 7, normal; again July 10 to 16 and August 28 to September 3, 1924. November 10, 1924, she reported that she started to stain October 18 and on examination the uterus was found to be as large as six to seven weeks' gravidity. November 29, 1924, she was still bleeding and a light curettage was done. Her next period was February 24 to 28, 1925. May 7, 1925, the uterus was found to be as large as a three months' gravidity, and there had been no bleeding since the February period. Quickening was felt about June 10 to 15, 1925. November 30, 1925, birth of male weighing nine pounds and four and a half ounces.

CASE 5.—F. B., twenty-two years of age, married one year. Menses began at thirteen years, always irregular, every five to six to seven to ten to twelve weeks, lasting five to six days. February 4, 1925, she stated that her last period was January 24 to 29, 1925, fourteen weeks after her previous menses. On examination the right adnexa were found to be definitely thickened, and the left adnexa was palpable and slightly enlarged, tender and prolapsed. February 16, 1925, she was given anterior pituitary tablets. X-ray treatment by Dr. Ira Kaplan March 12, 1925, right and left anterior abdomen 25 per cent. Her next period was April 1 to 4 about eleven weeks after the last period in January. June 4, 1925, on examination the uterus was definitely enlarged to six weeks' gravidity. Quickening was felt August 25, 1925. Birth of female child weighing seven pounds and six and a half ounces on January 16, 1926.

CASE 6.—L. S., thirty-three years of age, married sixteen years. Menses began at seventeen years, always irregular, every three, six, nine or twelve months. Her last period was September 26 to October 1, 1924. In 1913, following a curettage for

profuse bleeding, she had an amenorrhea for twelve months. October 16, 1924, on examination the uterus was plump; the right ovary was considerably enlarged. October 17, 1924, the uterus was insufflated and the tubes were found patent. The following period was October 19 to 26, 1924, one week early. The following period was December 25, 1924, to January 4, 1925. X-ray treatment by Dr. Ira Kaplan January 12, 1925, right and left anterior abdomen 20 per cent; January 21, 1925, right and left posterior abdomen 30 per cent; January 30, right and left anterior 15 per cent and 10 per cent to thyroid. She began to bleed March 12 to 14. The period was profuse and painful. The next period was April 12 to 16 and again May 11 to 16, 1925. May 20, 1925, she was given anterior pituitary and thyroid tablets, and the next period appeared June 8 to 13, 1925. August 26, 1925, she reported no bleeding since June and her uterus was found to be two months gravid. Quickening was felt October 26, 1925. This patient was delivered March 19, 1926, of a male child weighing seven pounds and four ounces.

CASE 7.—M. W., aged twenty-nine years, married eight years. Menses began at fourteen years, irregular every three to four months, duration two to three to four days with moderate flow. On October 31, 1924, she reported her last period to have been August 20 to 25, 1924, which had been two months after previous one. On examination the right adnexa were found to be enlarged, firm, and somewhat tender. Uterine insufflation was done October 31, 1924, and the tubes found to be patent. The next period was January 5 to 10, 1925, and again February 12 to 15; these periods were painless. February 20, 1925, she was given anterior pituitary extract. X-ray treatment by Dr. Charles Gottlieb, May 20, 1925, and June 3, 1925,  $\frac{1}{10}$  H. E. D. to each ovary, 200,000 volts. Without any intervening menstruation since February 12 to 15, when she was examined on July 27, 1925, the uterus was found to be enlarged to the size of an approximately ten to eleven weeks' gravidity. Quickening was first felt September 6, 1925, and she has advanced in pregnancy, the labor being expected February 15 to 28, 1926.\*

CASE 8.—S. E., aged twenty-four years, married two and a half years. Menses always irregular every six to seven to twelve months. On July 21, 1924, she reported her last period as of October 4 to 12, 1923. X-ray treatment October 22, 1924, after an amenorrhea of practically thirteen months, to the right and left anterior abdomen 18 per cent; October 28, 1924, right and left posterior abdomen 18 per cent; November 11, 1924, right and left anterior abdomen 22 per cent, by Dr. Ira Kaplan. Her next period was December 9, 1924, and again January 11, 1925. Physician reported birth of a male baby October 15, 1925, weighing seven pounds and six ounces. No opotherapy was used.

CASE 9.—C. G., thirty-one years of age, married six years. Menses began at sixteen years, irregular every six to seven weeks. During past three years every three to four months and duration five to six days. On January 24, 1925, she reported that her last period was January 2 to 7 and on examination the right ovary was found to be exceedingly hard, spherical but not tender. February 3, 1925, uterine insufflation was done and her tubes were found to be patent. The next period was February 5 to 9; this was the first time in six years that her periods were so close together. X-ray treatment by Dr. Charles Gottlieb, February 19, 1925,  $\frac{1}{10}$  H. E. D., 200,000 volts to each ovary. July 14, 1925, her physician reported that the patient was four months pregnant. No other data. No opotherapy was prescribed.

CASE 10.—M. R., thirty years old, married the first time thirteen years before for three years, second time ten years before. Menses began at fourteen years, always

\*This patient was delivered of a male child weighing nine pounds and one-half ounce on February 26, 1926.

irregular every two to three months. Her last period was November 1 to 5, 1923, and on examination the cervix was found to be small, the right adnexa distinctly palpable, slightly enlarged and somewhat tender. The left adnexa were slightly palpable but not thickened or tender. The cervix was typically infantile on inspection. Uterine insufflation November 13, 1923; tubes found to be patent. Her next period was December 8 to 12, 1923. December 18, she was given thyroid and lutein. Her weight was 160 pounds. October 24, 1924, x-ray treatment by Dr. Ira Kaplan right and left anterior abdomen 10 per cent of the castration dose, and November 7, 1924, right anterior 45 per cent of the castration dose and left anterior 40 per cent of the castration dose. The periods were practically unaffected by the x-ray treatment except that the first menses following the treatment was a little more profuse and the next three menstrual periods more nearly of the four week type. After this the periods returned to the five week interval. The patient has not become pregnant thus far.

CASE 11.—J. M., twenty-eight years old, married three and a half years. Menses began at thirteen years; were always regular four week type of four to five days' duration. The last menstrual period was May, 1913, eleven and a half years before. On examination the uterus was found to be small, the vagina atrophic and the adnexa not palpable. Uterine insufflation showed the tubes to be patent. X-ray treatment October 30, 1924, to the right anterior abdomen 10 per cent; left anterior abdomen 13 per cent; November 6, 1924, right and left anterior abdomen 40 per cent; November 12, 1924, right and left posterior abdomen 15 per cent; and November 12, 1924, right and left pituitary 15 per cent. The patient reports no return of menses and no pregnancy.

CASE 12.—R. P., twenty-four years old, married two years. Menses began at sixteen years, always irregular, from a month to one year late. Her last menstrual period was July 20 to 25, 1923, one year before. On examination the vagina was tight, cervix exceedingly small to touch, the uterus apparently subnormal in size, right ovary palpable and somewhat enlarged, left adnexa not felt. Uterine insufflation was done July 29, 1924, and her tubes were found to be patent. January 21, 1925, x-ray treatment right and left anterior abdomen 25 per cent; March 17, 1925, right and left anterior abdomen 25 per cent and right and left pituitary 10 per cent; March 24, 1925, right and left posterior abdomen 20 per cent, and her next period was May 2 to 7, after an amenorrhea of 22 months. The next one was July 15 to 21, 1925. This patient has not become pregnant thus far.

#### SUMMARY AND ANALYSIS OF CASES

Inasmuch as these patients were treated for sterility and not only for the habitual amenorrhea, the other factors entering into each case had to be considered. The male factor being satisfactory in all, special attention was given to the question of patency of the tubes. These were normal in all the cases but two, in which tubal insufflation had not been done. A third factor was the possibility of endocrine deficiency. Therefore the gland extracts were administered in most of the cases. In view of the possible therapeutic influence which may be ascribed to these two measures, I have felt it necessary to analyze the cases carefully in order to determine the real value of the x-ray treatment in cases of sterility associated with amenorrhea.

a. When the first period appeared after *x-ray treatment* in the *pregnant group*:

Two weeks after treatment in one case  
 Three weeks after treatment in one case  
 Six weeks after treatment in one case  
 Seven weeks after treatment in one case  
 Two months after treatment in one case  
 Four months after treatment in one case  
 Five months after treatment in one case  
 No data in two cases

In the *nonpregnant group*:

Five weeks after the x-ray treatment in one case  
 Thirteen weeks after the x-ray treatment in one case after an amenorrhea of twenty-two months  
 No return of menses in one case

b. *Opoththerapy* was given in the *pregnant group* as follows:

Preceding the x-ray treatment in five cases  
 After the x-ray treatment in one case  
 No opoththerapy was given in three cases

*Opoththerapy* was given in the *nonpregnant group* as follows:

Preceding the x-ray treatment in one case  
 No opoththerapy was given in two cases

c. *Uterine insufflation* was done in the cases that became *pregnant* as follows:

Preceding the x-ray treatment in six cases  
 Preceding and following the x-ray stimulation in one case  
 No insufflation was done in two cases

In the *nonpregnant group* *uterine insufflation* was done:

Preceding the x-ray treatment in all three cases

*Uterine insufflation* preceded the *x-ray treatment* in *pregnant group* by:

Two weeks in two cases  
 Three months in one case  
 Five months in one case  
 Nine months in one case  
 One year and four months in one case  
 Two months preceding and four months after last x-ray treatment in one case

In the *nonpregnant group* *insufflation* preceded *x-ray treatment* by:

Six weeks in one case  
 Six months in the other cases

d. In four of the treated cases the hypophysis area was also irradiated; two of these patients were in the nonpregnant group. One of the pregnant group received irradiation to the thyroid as well as to the ovaries.

e. Six cases went to term thus far.

Of the patients personally delivered six gave birth to males and one to a female. The sex of the baby in one case is not recorded.

One patient had two miscarriages, the first a female at five months, the second a male at six months.

The average weight of the babies at term is seven pounds and 14½ ounces. The largest was nine pounds and four and a half ounces and the smallest was seven pounds and four ounces.

*f.* Of those who became pregnant:

Two were married one year  
 One was married one and a half years  
 One was married three years  
 One was married six years  
 Two were married eight years  
 One was married fourteen years  
 One was married fifteen years

## Of those who did not become pregnant:

One was married two years  
 One was married three and a half years  
 One was married thirteen years

*g.* Conception took place following the x-ray treatment:

One month after x-ray treatment in two cases  
 Two months after x-ray treatment in one case  
 Three months after x-ray treatment in one case  
 Five months after x-ray treatment in one case  
 Six months after x-ray treatment in two cases  
 Ten months after x-ray treatment in one case  
 The same month in one case

As the duration of married life always enters into the consideration of the cause of sterility, it is well to note that of the nine patients who became pregnant, two were married only one year, one was married two and a half years and the remaining six were married three years or more. One of the latter dated her marriage fourteen years and another sixteen years. Inasmuch as the two young women who were married but one year suffered from marked amenorrhea, it may be justifiable to reckon the therapeutic value in favor of x-ray treatment.

Only in one of the successful cases was the finding noted that the adnexa were not palpable. In the eight others the ovaries were bilaterally or unilaterally definitely enlarged. This finding should serve as a guide, perhaps, in choosing the cases for therapy. It suggests the presence either of a persistent corpus luteum in some of the cases or it points to ovaries enlarged by excessive numbers of immatures ripening follicles. The latter occurs in certain cases where polymenorrhea precedes the amenorrhea.

## CONCLUSIONS

1. Habitual amenorrhea is associated with sterility in about 5 per cent of cases.

2. Pregnancy takes place in about 5.5 per cent of the untreated cases.

3. In nine out of twelve cases treated with mild doses of x-ray, pregnancy resulted (i.e., 75 per cent of the treated cases). Only one of these patients aborted. The rest carried to full term and gave



birth to normal children. Among seven of the latter personally delivered there were six males and one female.

4. X-ray irradiation of the ovaries resulted in restoration of the menses in eleven out of twelve cases of amenorrhea.

5. X-ray irradiation of the hypophysis area and the thyroid appears to have an adjuvant value. Two of the pregnant cases and two of the nonpregnant cases received hypophyseal irradiation. One of the pregnant cases also received thyroid irradiation.

6. Peruterine tubal insufflation and endocrine therapy are additional aids to the therapeutic action of the x-rays in cases of amenorrhea associated with sterility.

7. As the ovaries were found to be definitely enlarged before treatment in eight of the nine successful cases treated with x-rays, careful examination with regard to this point may prove of aid in selecting the cases of amenorrhea associated with sterility suitable for ovarian stimulation. When no ovarian enlargement is found, irradiation to the hypophyseal area or the thyroid, etc., may be more advisable and should certainly precede irradiation of the ovaries.

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- <sup>3</sup>Mathews, H. B.: *Trans. Am. Gynec. Soc.*, 48th year, vi, 614.
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(For discussion see page 130.)

# THE CONSERVATIVE TREATMENT OF UNCOMPLICATED RETRODISPLACEMENT OF THE UTERUS\*

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## INTRODUCTION

IN CONSIDERING the problem embodied in the title of this paper, I have deviated somewhat from the path of custom and have included not only the treatment of uncomplicated displacement of the uterus, but certain other phases of the trouble as well. This unfortunately prolongs my introductory remarks, but is justified on the ground that they embrace certain features of the subject which I regard more important than the treatment of the condition itself.

In the brief span of ten years all departments of science have made phenomenal progress and it is obvious to all that the science of medicine has kept quite abreast of scientific progress in general.

Specialization has played a definite influential rôle in this evolutionary period, but specialization, while prominently displaying its burnished side of beneficence, at first, unfortunately, exposed a drab side of passionate radicalism. This feature of specialization has been largely overcome by repeated assaults, and, thanks to a sound philosophy, it has gradually been settling toward a rational conservatism.

The specialty devoted to the diseases peculiar to women has contributed a gratifying quota to specialization and, while there is still much to be desired from the conservative aspect, gynecology no longer can be regarded as ultraradical.

The conservative wave, starting as a faint ripple about twenty-five years ago, has developed into an expanding billow and the crest of the wave is not yet in sight. It is destined to broaden and ultimately will embrace certain pelvic disorders which are still looked upon as surgical.

We can scarcely accuse our eminent predecessors of ignorance with regard to the fundamental importance of conservative effort in dealing with organs, first, of fathomless systemic value and, second, in propagating the human family, yet the former practice of indiscriminate and oftentimes sacrificial surgery is wholly beyond the comprehension of men active in gynecology today.

Within the past decade certain genital disorders, heretofore regarded as wholly surgical, have fallen in the category of medical or at least semimedical conditions. These include the acute pelvic infec-

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tions, infected abortions, simple uterine displacements, uterine myomas and uterine carcinoma. To all of the conditions named operative therapy was formerly almost routinely applied.

During the past ten years progress along conservative lines has been almost beyond belief and it is quite safe to say that during this period operative gynecology has decreased at least 25 per cent.

It is probable, though I realize it is dangerous to deal in prophecy, that the next ten years will see the conservative pendulum swing still farther, so much so that gynecology may not be the alluring surgical specialty it has been in the past. Indeed, it is quite conceivable that only a few pelvic conditions will be looked upon as truly surgical, such, for example, as pathologic displacements, partial or complete uterine prolapse, ovarian neoplasms, severe parturitional damage, frank pus collections and large pelvic neoplasms. It is not beyond hope that even some of these, especially uterine tumors, will rarely require surgery, since by early recognition and prompt irradiation they will not attain surgical proportions. Gross obstetric lesions will, I believe, be largely prevented by the adoption and practice of intelligent obstetric strategy and more skillful, as well as discriminating obstetric tactics.

Among the pelvic conditions which have presented a comely figure to the practicing gynecologist, a group which developed an early and abiding infatuation and one to which assiduous court has long been paid, was uterine displacements. Indeed, of the manifold disorders arising in the female pelvis, none have presented a more alluring physiognomy than malpositions of the womb.

Since the discussion of the title of my paper is governed by the qualifying term "uncomplicated," it seems proper that my interpretation of the phrase be explained.

There should be no serious difficulty, if difficulty at all, in defining and recognizing either a simple or a complicated uterine displacement.

Each type has characteristic features. I believe that most physicians would regard a retroposed uterus of relatively normal size, freely movable and occurring in young single women or young nulliparous married women as one of the uncomplicated variety. I am equally sure that most observers would also regard a uterus of normal size, one not constantly anterior or posterior arising in the type of patients to whom reference has just been made, as truly uncomplicated.

As regards the complicated or pathologic displacement, it is rarely found in young, single women or young women who have not borne children. The organ generally is in constant retroposition and in nearly all instances, owing to the hyperplastic alteration of its walls, it is frankly enlarged. The increased weight of the structure com-

bined with the intraabdominal pressure may imprison it in the hollow of the sacrum or it may thus be fixed as the result of periuterine infection. The condition usually is a sequel of parturition, so the displacement itself in most cases is associated with parturitional injury. A complicated displacement, then, is one associated with definite pathologic alteration in the uterus itself, in the circumjacent structures, or in both.

There is still another form of posterior displacement deserving mention. I refer to those cases so commonly found in highly neurotic, physically incompetent women.

The number of this variety operated upon is beyond computation. Have many, if any, ever been benefited? It is obvious that displaced uteri arising in patients of this so-called neurasthenic group are in no sense pathologic in themselves but rather a manifestation of the general passive or subnormal condition of the patient herself.

*Symptoms.*—Probably no conditions arising in the human body have been so falsely accused of creating symptoms, both systemic and local, as innocent, not pathologic, uterine displacements. For no other disturbances have such an array of therapeutic methods, both medical and surgical, been designed with almost equally uniform failure in affording symptomatic relief.

Normally, the uterine body is a freely movable organ and, so long as it is normal in size and freely movable, may it not be, from a physiologic as well as from an anatomic standpoint, as normal posteriorly as it is anteriorly?

The teaching that the uterus is maintained in position by a combination of the pelvic ligaments, it seems to me, is not physically or anatomically true. Except during pregnancy, the pelvic ligaments do not act as stays or supports, as we have been so long taught. Personally, I have never observed, save during pregnancy, the round and associated ligaments, especially the round ligaments, to act other than in a simple passive capacity. Fothergill states: "Though all the ligamentous structures attached to the uterus, except the cervicopelvic muscle bands, be severed, the organ will remain in the so-called normal position."

Usually the round ligaments are observed as two cylindrical or ribbon-like cords passively traversing the sides of the pelvis from the internal abdominal rings to the uterine coruna. Rarely are they seen in a state to imply that they in any way act as a sustaining force of the uterus.

It is commonly assumed that a great variety of symptoms may be caused by simple displacements, but it is clear that the mere association of symptoms cannot be explained either on anatomic or pathologic grounds, for simple displacements are not pathologic. Unless

the displacement is frankly complicated it cannot excite symptoms. If one could accept the hypothesis that a simple displacement of the uterus inhibits the supreme function of the organ, namely, child-bearing, then one might assume that our Creator adopted this as one of the chief methods of exterminating the human race.

Except in very rare instances, an uncomplicated displacement cannot possibly interfere with conception or any other function. If this were the common source of female sterility, the condition would be infinitely more frequent than it is. Indeed, it may not be far of the mark to say that 25 per cent or more women of the childbearing age would be found in this class.

Personally, I am familiar with no data which prove that simple retrodisplacements bear an etiologic relationship to sterility. In all our literature reference is made to this subject, but there are no data on which one can base a positive conclusion. Sterility is often cited as a sequel of retrodisplacements, but rarely is the story fully told. There is a vast difference between a one-year, two-year, three- and five-year sterility. Simple displacements must play but a minor rôle in the barrenness of women.

While sterility is usually set forth as one of the symptoms of retroposed uteri in one paragraph, the paradox of the possibility of abortion taking place is mentioned in the next.

That this unfortunate termination of pregnancy may take place in uteri imprisoned underneath the sacral promontory, no one will deny, but pelvic incarceration of a gravid uterus is an exceedingly infrequent occurrence. In an experience extending over a period of several years, I have not observed this combination of conditions.

With regard to the teaching, more or less prevalent, that, if pregnancy should occur, a simple displacement might jeopardize the fate of the embryo by expelling it prematurely, is, I am convinced, a species of gynecologic pedagogy not wholly true. Abortion occasionally may occur, just as it does occur occasionally under entirely normal circumstances, but that it is a common cause of abortion, I regard as exceedingly doubtful.

Impaction with abortion as a sequel is possible, but how often has it been observed? The "danger" to a pregnancy complicating a simple displacement is overemphasized. In this connection, I hesitate to use the word "coercion," but I do know the term in the form of a method is sometimes employed in impressing a patient with the "seriousness" of the trouble and I regret to say it also occasionally is used in equally impressing a patient with the "necessity" of surgical interference. The magnitude of the symptom complex, so frequently ascribed to retroposition of the uterus, to me, seems incredulous and cannot be explained on rational grounds.

Indeed, nearly every conceivable symptom, as nervousness, functional and even organic; sterility, leucorrhea, disturbed menstruation, dyspareunia, irritation of the bladder and bowel and, of course, the Nemesis of all women, backache, is often attributed to simple uterine displacements.

Chipman quotes La Rochefaucold, who said: "Pain is the greatest liar in the world," and Chipman goes farther, asserting that, of the painful liars extant, "backache is the greatest Ananias or Sapphira of all."

The men propounding this threadbare doctrine ostensibly believe with the ancients that the uterus has the unusual facility of sailing about like a rudderless ship, ultimately anchoring itself in some favored section of the body.

The teaching is utterly false and the party to benefit thereby is obviously not the patient, but the individual who unscrupulously lends himself to such an iniquitous system of medical banditry—a system which:

"May have heaven in its looks,  
But hell in its name."

It is taught, too, by men who I am confident know better, but taught nevertheless, words—words:

"In each of which the teacher shakes a lance,  
Though brandished in the eyes of ignorance."

I am fully conscious of the feeling respecting the current of thought encircling the topic of uterine displacements. I realize, as I am sure you all do, that there is still a wide diversity of opinion concerning all features of the subject.

Unanimity of opinion has not crystallized regarding the symptomatology and treatment of displacements and perhaps it never will. But unanimity of opinion rarely applies to anything and it would be obviously unnatural to expect a unanimous judgment with regard to this phase of gynecology.

In this country two interesting papers have recently appeared, one by Dr. Arthur Dean Bevan, if not wholly condemning, advocating at least a reversal of our attitude with respect both to the symptoms and treatment of backward displacements. The other paper, analyzing all features of the trouble and advocating a more compromising attitude, indicates that its author, Dr. George Gray Ward, Jr., believes that certain displacements are influential in exciting symptoms and that in these, surgery is not only justifiable, but successful.

In England, too, at the recent meeting of the British Medical Association, at Bath, a lengthy paper was presented, depicting and ascribing

ing a long chain of symptoms as due to simple backward displacement. In this contribution surgical therapy was strongly advocated, but in the lengthy discussion which followed, the contentions of the contributor were not supported. By the various gentlemen who took part in the discussion, ten in all, a middle course was advised. In therapy, surgery was given second place.

Bevan in his paper, to which I have already referred, expresses his convictions regarding displacements in the following language: "Thirty years or more ago, as a young surgeon, I was very skeptical about the local and general symptoms ascribed to retroposition of the uterus. I could not understand how a movable retroposed uterus could excite symptoms any more than a mobile sigmoid which might fall backward or forward or right or left. I soon found that patients upon whom I operated and brought the uterus forward in the supposed normal position, were not only not benefited, but many were made worse by the operation, so I, therefore, early discarded it as unnecessary and illogical."

Looking upon this problem, he says, as a piece of scientific research, we are in a position today to state that uncomplicated, movable retroposed uteri produce no symptoms and that operative procedures on such cases must emphatically be condemned.

The retroversion question has also been clearly set forth by Jaschke. In a study of 1000 cases of retroposition, compared with 1000 cases of ante-position, this observer found that the supposed characteristic symptoms of retroposition: menorrhagia, leucorrhea, dysmenorrhea, constipation, bladder irritation, backache, and sterility, occurred just as often in the anterior as they did in the posterior position.

Jaschke has reached the conclusion, therefore, that an uncomplicated retroposed, movable uterus causes no characteristic symptoms of any kind and no characteristic distress.

Realizing that my paper is dedicated to an analysis of uncomplicated retrodisplacement of the uterus, it may not be regarded as apropos to even mention that insignificant entity, if really an entity at all, antedisplacement. It would be a fatuous waste, indeed, of priceless time to even attempt to review the multiplicity of symptoms and the mammoth therapeutic pyramid erected to the glorification of this pigmy of gynecologic deities.

Personally, I do not believe a simple antedisplacement, one regarded as beyond the so-called natural ante-flexion, is capable of exciting symptoms.

A pin-hole as I have never seen, nor have I ever observed a cervical canal, the channel through which the menstrual fluid makes its exit from the uterine cavity, with a diameter less than the diameter of a red or white blood cell. Menstrual symptoms associated with ante-

position must, therefore, be looked for in structures other than the uterine body.

The train of symptoms often ascribed to an acutely anteфлекed uterus is most frequently found associated with the type of organ classified as the infantile variety. This is most commonly observed in individuals who present anything but infantile characteristics. These patients, on the contrary, are, in the main, of the gigantic type. This feature in itself clearly indicates that the source of the trouble is not in the uterus, but in some derangement of the endocrine system. Herein lies the origin not only of the maldeveloped uterus, but of the dysfunction, expressed symptomatically in dysmenorrhea, partial or absolute amenorrhea and sterility, as well as the bearded face, masculinity, moderate or mammoth body development combined with an anteposed, ill developed uterus; these form a symptom and sign complex which speaks with plain intelligence of the fountain head of the trouble.

It is a common observation that the bigger the patient the smaller the uterus and the more profound the functional derangement.

*Treatment.*—I have devoted considerable time to the general discussion and symptomatology of simple uterine displacements, because I believe the study of these phases of the subject is more important than the treatment of the displacement itself.

In considering the therapy of simple displacements, while it may shelter one from argument, if not criticism, by assuming a compromising middle course, I shall steer clear of compromise, because I believe, except in very rare instances, a *simple displacement of the uterus is not worth treating*. As Goldsmith said of Burke: "I select this course not because it is expedient, but because I regard it as right."

A study of events discloses that the round ligament operation, a consuming epidemic procedure a few years ago, is now being employed only sporadically.

The late Dr. Watkins said: "The round ligament operation seems to have ceased to be a subject of much general interest."

I am sure we are all familiar with the conservative trend in the treatment of simple displacements and this does not indicate that the trouble is less frequent, but that a mature surgical conscience has discovered therapy is rarely necessary.

Indeed, if the conservative plan gradually evolved and adopted during the past few years could be regarded as a criterion of the future, it is obvious that uncomplicated cases will be treated, if treated at all, along ultraconservative lines. It is probable that simple malpositions will be regarded more from a physioanatomic and



not from a pathologic standpoint. Today the round ligament operation in uncomplicated cases, I rarely recommend or perform.

The only type of displacement which one may legitimately place in the category of a surgical displacement is the large hyperplastic uterus, or the large chronically inflamed adherent uterus or the pathologic prolapsed uterus. In these, considerably more surgery than simply shortening the round ligaments or fixing the uterus forward is called for.

The practice of major surgery for a minor condition is not good surgery and it is prudent to keep in mind that all forms of surgery exact a definite toll of human life.

If one may regard a multiplicity of therapeutic measures as sound evidence that none are wholly satisfactory, then at least some of those designed for simple retrodisplacement may be included in that chapter. More than 100 different operative methods have been devised and next to the pernicious operation of dilatation and curettement, I am not familiar with any that have had less justification or done less good. Ten years ago the round ligament operation constituted more than 10 per cent of the work of the gynecologist. I am persuaded that today it could be reduced to less than 2 per cent and all that is needed to see the consummation of this belief is a righteous surgical conscience. In simple cases it may be used occasionally as a matter of expediency in the course of other pelvic work, but rarely as a matter of principle or on primary organic grounds.

As regards the therapy of antelexion, I have very little to say. To me it seems physically impossible to correct an ill developed ante-posed uterus by either medical or surgical means.

Personally, I believe a grossly maldeveloped antelexed uterus will remain maldeveloped and probably antelexed forever, irrespective of any type of treatment.

So far as therapy is concerned, uteri of this form might legitimately be placed in the category of incurable conditions.

If, however, the ill development is of moderate extent, some good may be accomplished by a restricted dietary regime, combined with the administration of organic drugs. Apart from these measures, and even they afford but slight encouragement to either the patient or the physician, there is little one can do.

Surgery in the form of dilatation and curettement alone or combined with a uterine stem pessary or the various mutilating operations on the cervix itself, may occasionally provide some comfort, but surgery, too, generally is disappointing, is not without features inimical to the integrity of the cervical mucosa and indeed not without danger even of a more serious character.

The stand I have taken respecting the symptoms of uncomplicated displacements of the uterus, I realize fully will not meet with universal approbation. It perhaps, on the contrary, will be greeted by condemnation, but I do believe I have expressed a conviction which is gradually becoming and is destined to become more and more universally recognized.

I may be accused also of taking an ultra pessimistic point of view regarding the surgical therapy of simple displacement, but I feel justified in assuming a discouraging attitude because it is sustained, first, by the decreasing frequency with which operations are being performed; second, by the almost universal condemnation of surgical means, and third, by the almost uniform failure in my hands of operative treatment affording symptomatic relief. Two hundred years ago Alexander Pope in his *Essay on Criticism* said:

“ 'Tis hard to say, if greater want of skill  
Appear in writing or in judging ill;  
But, of the two, less dangerous is the offense  
To tire our patience, than mislead our sense.  
'Tis with our judgments as our watches, none  
Go just alike, yet each believes his own.”

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 1621 SPRUCE STREET.

(For discussion see page 134.)

## AIR INSUFFLATION OF THE TUBES\*

By PETER GRAFFAGNINO, M.D., NEW ORLEANS, LA.

FOR more than two years the Rubin method for the determination of tubal patency has been used in our clinic at Charity Hospital with such good results that a brief description of the technic and indications is warranted at this time. In the beginning our apparatus was that originally described by Rubin, carbon dioxide gas being the insufflating agent, and his technic was followed in practically every detail. Recently, however, we have modified the method somewhat, with the idea of making possible a wider application, and making its employment practicable not only in the operating room but also in the physician's office or even the patient's room. As shown by the illustration, we have simply substituted the air bulb of the blood pressure apparatus for the carbon dioxide tank, thereby making the apparatus portable and simplifying the entire procedure very markedly.

We believe that this method should be utilized in every instance in which the cause of a woman's sterility is of doubtful origin, and certainly before operation of any sort is ever attempted for the relief of the condition. Our principal indications are:

1. To determine the patency of the fallopian tubes in cases of sterility.
2. To determine the patency of the fallopian tubes as an indication of their involvement in chronic pelvic inflammatory disease or other pelvic pathology.
3. To assist in keeping the tubes open following conservative operative procedures.
4. To determine the ultimate success of operative procedures for opening occluded tubes.

By using this modification of the Rubin apparatus we have found that the following important details of technic can be controlled and a maximum amount of information be obtained from the examination:

1. A constant low pressure of gas or air can be maintained automatically.
2. The rate or flow of the insufflating agent can be regulated accurately.
3. The volume of gas or air which passes into the abdomen can be measured by the siphon meter.
4. Intrauterine pressure can be recorded by means of the mercury manometer.

It should be emphasized that patients are never examined in the

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\*Read before the New Orleans Gynecological and Obstetrical Society, Meeting of February 18, 1926.

presence of purulent or bloody vaginal discharges, nor is examination ever attempted in patients who have acute pelvic inflammatory disease or serious organic disease, particularly cardiac lesions.

The examination is made under the most rigid aseptic precautions possible. After the patient has been placed in the lithotomy position, and the cervix and vagina have been carefully cleansed, the cervix is exposed by the use of a weighted or Sims speculum, and the cervix and cervical canal are painted with  $3\frac{1}{2}$  per cent tincture of iodine. The anterior lip is grasped with the vulsellum, the uterine canal measured with a sound, and the direction of the fundus noted. The rubber tip of the cannula is now adjusted to the size of the canal; the cannula is introduced, and the rubber tip fitted as snugly as possible against

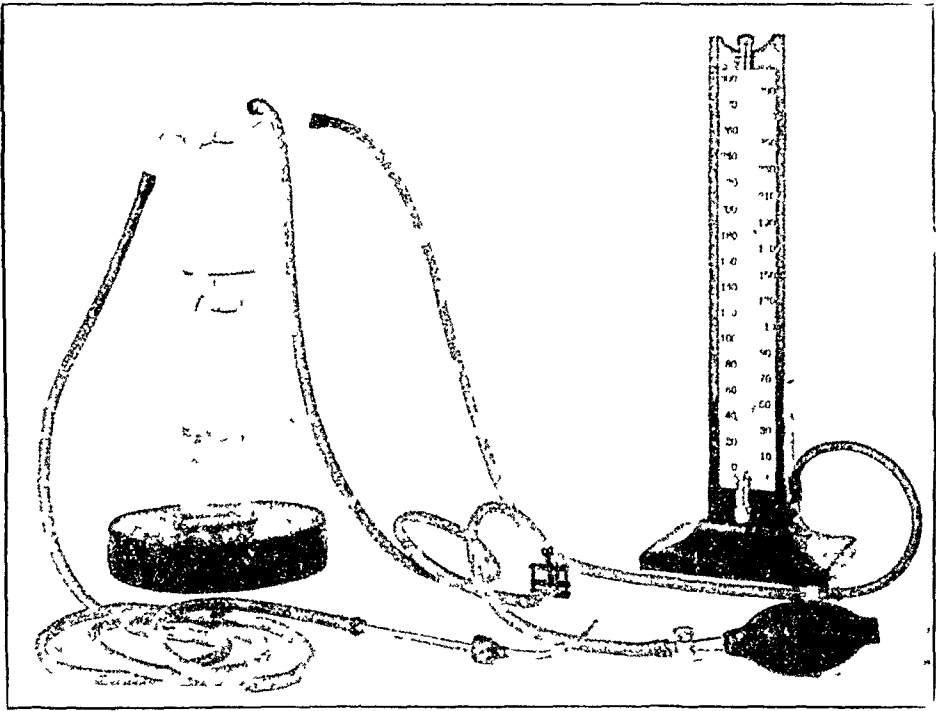


Fig. 1.

the cervix to avoid the escape of the air. The apparatus is now adjusted and connected, and the air allowed to flow gently, so that it will take about twenty seconds for the column of mercury to rise from zero to 100 mm. The volume of air which has passed into the abdomen can easily be measured by counting the number of pulsations or excursions of the air in the siphon meter, about 40 c.c. of air passing into the abdomen with each excursion. Not more than 300 c.c. of air should be introduced when the modified Rubin apparatus is used, because air is not so readily absorbed, often remaining more than forty-eight hours, so that very distressing pressure symptoms may ensue, particularly if the patient is in any way active. Carbon dioxide, on the other hand, is absorbed so rapidly from the abdomen that the symptoms from the

amount used in an average examination will disappear within fifteen to thirty minutes.

If the pressure findings indicate any degree of obstruction to the passage of air through the tubes, too much reliance should not be placed upon one examination, nor is the result of an examination reliable when the patient is near her menstrual period. Examination should not be done within a week before or a week following a period, as the congestion of menstruation may cause partial or complete obstruction of the tubes, and even in a patient whose periods are ordinarily regular some irregularity of time may be present. For some reason, which we have not yet been able to fathom, occasional cases will be found to have occluded tubes at one examination which are patent at subsequent examinations. If we find the tubes obstructed at one examination and can find no definite cause for the obstruction, we examine the patient at least twice more, on different occasions, before we make a definite statement as to the patency of the tubes.

There are three ways of knowing whether or not the air has passed into the abdomen:

1. Pressure findings. A drop in intrauterine pressure during the examination, if there has been no leak about the cannula in the cervix, means that air has passed through one or both tubes. An intrauterine pressure of 200 mm. on repeated trials indicates that both tubes are closed.

2. Shoulder pain. As soon as the patient assumes the upright position she may have pain in one shoulder or both. This symptom we have found to be present in over 90 per cent of the cases in which the air has passed into the abdomen, and we therefore accept it as practically positive evidence that the tubes are patent.

3. Fluoroscopic examination. If the patient is examined in the upright position after the air has passed into the abdomen a layer of the air can easily be seen beneath the diaphragm. At first we routinely subjected all our patients to fluoroscopic examination, but this was later discontinued, and we now fluoroscope only those patients in whom shoulder pain does not develop, particularly if a drop in pressure has occurred.

Most patients complain of some discomfort during the examination, and the shoulder pain, to which reference has been made, in some instances is quite severe. If they are taken into a dark room for fluoroscopic examination a certain number will faint as a result of the shoulder pain and apprehension.

That the method has some therapeutic value, as well as a definite diagnostic value, is beyond question. Various writers have reported cases of pregnancy following simple insufflation of the tubes in undoubtedly sterile women, and it is perfectly possible that the entrance of the gas or air into the tubes, under pressure, will expel mucous

plugs from them, separate agglutinated surfaces, and straighten out kinking which may have taken place along their course. In our hands, however, the procedure is largely a diagnostic one, and it is from that standpoint in particular that we commend it to you.

#### CONCLUSIONS

1. The modified Rubin method for the determination of tubal patency is a simple and safe diagnostic procedure, the portable apparatus being its principal advantage.

2. If details in technic are carefully observed, an accurate opinion as to the condition of the tubes can be given in at least 85 per cent of the cases examined.

3. Patients should not be examined near a menstrual period, or in the presence of acute pelvic inflammatory disease or serious organic lesions, especially heart disease.

4. All cases of sterility in which a definite diagnosis of the cause cannot be made by bimanual pelvic examination should be insufflated.

5. The method is almost entirely diagnostic, although it has some therapeutic value, and pregnancy will follow in a small percentage of the cases.

PHYSICIANS' AND SURGEONS' BUILDING.

(For discussion see page 135.)

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### SARCOMA OF THE STOMACH\*

BY GEORGE F. CHANDLER, M.D., F.A.C.S., KINGSTON, N. Y.

ON JUNE 12, 1923, a woman thirty-eight years of age, the mother of four children, whose last child was born thirteen months before, came to my office for an examination. She stated that she was pregnant and asked advice as to when she should enter the hospital for her next child. She was pale and so weak that every effort exhausted her. She had been vomiting for nearly six months, perhaps once a week at first, with gradually increasing frequency. There was no blood in the vomitus. She thought at times that she had felt quickening but was not sure. Her menses had never appeared since her last child, and she was therefore at a loss to know how far pregnant she was.

Upon examination I found the uterus normal, but found a large tumor in mid-abdomen, which simulated a pregnant uterus. The mass was round, filled the abdomen, and was movable, but did not seem to be attached to anything. It seemed softer than a fibroid. I was sure it was not an ovarian cyst. It was not connected with the liver or spleen, and as she was so emaciated, I could feel each kidney. I felt that she was entitled to an operation since the tumor was movable.

She entered the hospital the next day, and the morning following I opened the abdomen. The mass was of bluish color shining through the omentum. On lifting up the greater omentum, I found that the mass was in the lesser sac of the peritoneum, pulling down the stomach and stretching the gastrocolic omentum. I

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\*Read at the Thirty-eighth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, Hot Springs, Va., September 16, 17 and 18, 1925.

opened the lesser sac through the gastrocolic fold just to the right of the colicamedia artery, and expressed from the lesser sac a tumor practically round, eight and one-half inches wide by nine and one-half inches from above downwards. It weighed nearly nine pounds; it was solid, attached to a broad pedicle about two and one-half inches wide, and the thickness of a finger. It was attached to the greater curvature of the stomach posteriorly.

The patient's condition at this time was very bad.

I rapidly clamped the pedicle with curved clamps that followed the symmetry of the greater curvature and tied off large vessels individually in the stump, then removed the clamp and covered in the stump with a running suture. A running suture closed the omentum, and a rapid closure of the abdomen followed without drainage.

We despaired of the patient's life for six days, when she began to gain, and finally, much to our surprise, made a recovery. She is today, after two years and three months, a well, strong woman who has gained twenty pounds and says that she has never felt better in her life.

The pathologist reported that the growth was a small, round-celled sarcoma.

Sarcoma of the stomach is one of the rarest conditions presented to the surgeon. According to W. D. Haggard, Bruch in 1847 put on record the first case of primary gastric sarcoma, and Virchow in 1887 operated upon the first patient for this condition. Up to 1912 there were but 61 reported cases with eleven survivals after operation, ranging from three months to seven and one-half years.

In 1914, Flebbe collected 157 cases based on autopsy findings. There had been up to 1920, according to Haggard, but 107 operative cases. Therefore, the total recorded cases of sarcoma of the stomach, up to 1920, of autopsy or operative cases are 244. Since then, I can find only 19 published articles on this subject in this or in any other country, totaling not over thirty more cases. A condition that totals but 274 reported specimens (operative and autopsy together) must be a rare one.

The largest case on record is one presented by Cantwell in which the tumor weighed twelve pounds. Pagenstecher records one weighing eleven pounds. These two cases are the only ones that I can find in which the tumors were larger than that of my own case.

The sex of the patient has no bearing on the frequency of the lesion, it being equally divided. The age limit is from three years to eighty years, but the most common age is 41.6 years, differing from carcinoma, which is 61.2 years, according to the last U. S. Census reports.

There are three groups of cases, viz.: spindle-cell myosarcoma, lymphosarcoma, and miscellaneous round-celled sarcoma.

Douglas states that round cell and lymphosarcomata increases more slowly in size than spindle cell, and judging from the statistics of the progress of the disease, cases of sarcoma of the stomach metastasize less rapidly than carcinoma, and the length of life after the appearance of the disease in nonoperative cases appears to be longer than in carcinoma cases. Therefore operative results should afford a better prognosis than in carcinoma.

It would seem that a benign tumor of the stomach may exist for years, and then gradually become a sarcoma. One such case has been reported by Kimpton where

he resected the stomach for a round-celled sarcoma at the age of thirty years. The patient had noticed this tumor since she was eleven years of age, which case would seem to prove this. These tumors metastasize much less rapidly than do carcinomata. When metastasis does occur the lymph nodes of the stomach are first affected and then the liver, but the general tendency is not to metastasize.

Forni reports that round-celled make up two-thirds of all gastric sarcomata; spindle-celled, less than one-third, and lymphosarcoma, a small percentage.

Ulceration seems to be rare as a rule in this class of tumor, and as the site of the tumor is near, but not commonly in the pylorus, there is less obstruction than in carcinoma.

Early diagnosis with successful removal means a much better prognosis than in carcinoma for this reason.

Overton's patient lived ten years after operation; Krause's patient lived seven and one-half years; Kimpton's five years and ten months; the Mayo's four years, and Douglas of New York has written me that, out of his three cases of this condition, the one that lived was well and healthy six years and six months after operation.

The diagnosis is often impossible. There may be no gastric symptoms at all. The loss of flesh is marked and there is anemia, weakness and frequently hemorrhage from the stomach or in the stools. There is rarely obstruction, as in carcinoma, and the tumor is usually much larger.

I did not use the x-ray nor the fluoroscope, but I believe that the fluoroscope should be used. I doubt if the x-ray would be of much advantage.

NOTE: Since writing this article, I have found five additional cases of Sarcoma of the Stomach noted in The Surgical Clinics of North America for August, 1925, v, No. 4.

11 EAST CHESTNUT STREET.

*(For discussion see page 122.)*



# THE INTRAVENOUS MAGNESIUM SULPHATE TREATMENT OF ECLAMPSIA\*.

## A COLLECTIVE REPORT OF 142 CASES

BY E. M. LAZARD, M.D., F.A.C.S., JOHN C. IRWIN, M.D., AND  
JOHN VRUWINK, M.D., LOS ANGELES, CALIF.

*(From the Obstetrical Department, Los Angeles General Hospital)*

IN OCTOBER, 1924, one of us (Lazard, AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, February, 1925) reported to the Los Angeles Obstetrical Society, the results in a series of twenty cases of eclampsia treated by the intravenous use of magnesium sulphate at the Los Angeles General Hospital. In May, 1925, we were appointed a committee of the Los Angeles Obstetrical Society to collect and report on all available cases which had been treated by this method. We have now records of 142 cases, reported from hospitals and doctors in and around Los Angeles; a few being reported from more distant points.

Most of the cases were from the Los Angeles General Hospital and of the others, many were either under the immediate charge of or were seen in consultation by members of the obstetrical staff of the Los Angeles General Hospital.

We have to thank the managements and staff doctors of the Methodist, California Lutheran, Hollywood, Kaspere Cohn, White Memorial, Florence Crittenton Home, St. Vincent's Maternity Hospitals, and the several doctors who personally reported cases to us, for permission to include their cases in this report.

For purposes of this study, we have included under the term, "eclamptic toxemia," all toxemias of pregnancy which have resulted in convulsions or, in which treatment has been directed toward the prevention of convulsions (preeclamptic toxemias). These cases naturally fall into three classes from an etiologic standpoint.

(1) The true eclampsia (so-called, for the want of a better term) in which the toxemia is the result of some primary toxin, incident to the pregnancy and to which there is added toxemia of liver deficiency and of kidney deficiency (toxic nephrosis). These cases can only be differentiated from the second class by the absence of antecedent history of renal disturbance, by the practically normal blood chemistry and, in case of recovery, by the comparatively rapid return to normal of blood pressure readings and urinary findings; in case of death, by the typical liver changes and lack of any chronic renal changes.

(2) The nephritic eclampsias, which are merely nephritic uremias of the pregnant; these cases are differentiated by the history of antecedent nephritis, the long

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\*Read at a joint meeting of the Los Angeles Obstetrical Society and the Los Angeles County Medical Association, February 18, 1926.

continued high blood pressure and albuminuria before the onset of eclampsia, by the high values of retention products in the blood, by the comparatively few eclamptic seizures (unless there be complete anuria) and the prolonged uremic coma and delirium; in case of recovery, by the persistence of high blood pressure and urinary evidence of nephritis, by the tendency to recur with succeeding pregnancies, and in case of death, by the autopsy findings of chronic nephritis with few or no liver changes.

(3) That class of cases in which there is superimposed on a mild chronic nephritis, a true eclamptic toxemia.

*Preeclamptic Toxemias.*—There have been 45 cases, 23 General Hospital and 22 outside cases of toxemia which have received intravenous magnesium sulphate, in addition to the usual preeclamptic treatment, in an attempt to prevent the occurrence of eclampsia (convulsions and coma). Of these cases, nine were given their first injection during labor and three had their first injections postpartum. These were given as prophylactic doses because the patients had high blood pressure, 150 to 240, all but one had albuminuria and casts, and all had headache or edema or both. Thirty-three were started on the treatment from one day to four weeks antepartum; coming under treatment as preeclamptic cases. They received doses of from one injection of 20 c.c. to 24 injections of 20 c.c. each, this last one over a period of twenty-three days.

Of the forty-five patients, six developed convulsions, four of whom had had but one injection, one had had four injections and one had had three injections. In two patients, the convulsions (Cases 2 and 5) developed within twenty-four hours of the beginning of the treatment, in one patient (10) forty-eight hours after her only injection (not given enough), one patient (22) on the sixth day postpartum after having been given one injection at time of labor, and one patient (45) had her only convulsion postpartum after being under treatment for two weeks, antepartum.

Of these 45 patients, 30 had spontaneous deliveries; three, induced labors; five, assisted labors (forceps or version) and seven had cesarean sections. Of the babies, there were 34 living babies, 6 premature stillbirths and 3 full-term stillbirths. One of the full-term stillbirths was due to a premature separation of the placenta.

One patient, (14) a primipara, was referred by her doctor to the General Hospital, for emptying of the uterus because of her toxemic condition at the thirty-fourth week of her pregnancy. She was carried four weeks to spontaneous delivery of a living baby without the occurrence of convulsions.

Two patients were treated in two pregnancies for toxemia. One patient, Case 8, was admitted 4/10/25 as a preeclamptic. This was the same patient as Case 6 of the eclamptic series, who was in the hospital 7/14/24. On her first admission, she was in convulsions when admitted, was given magnesium sulphate intravenously, and the next day delivered spontaneously a stillborn child, making a good recovery. On her second admission, nine months later, she was eight months pregnant, had

a blood pressure of 240/132, albumin ++; she was again given the magnesium sulphate intravenously, and four days later, delivered spontaneously a living baby. She had no convulsions and made a good recovery. This was probably a nephritic toxemia.

This patient, Case 4, admitted 12/20/24, a nephritic with marked general edema, albumin ++++ and casts, had six intravenous injections, a bag induction on 12/31/24 with spontaneous delivery of a premature stillborn child, returned to the hospital 11/8/25. Another patient, Case 21, five and a half months pregnant, with marked generalized edema, blood pressure 190/150, albumin ++++, casts ++, had six injections of magnesium sulphate, with little effect on the general condition, except that she did not develop convulsions or coma, she had a bag induction on 11/12/25. The next day, there being no response to the bag insertion, it was removed and the resident physician dilated manually sufficiently to deliver the five and a half month stillborn fetus. In the manipulation, the very edematous cervix was lacerated but with little apparent bleeding at the time. Two hours later, the patient was in shock and died four hours after delivery. The autopsy revealed marked subacute nephritis, extensive laceration of cervix into base of right broad ligament and extensive hemorrhage into retroperitoneal region of pelvis around vagina and cervix. Liver was very pale with central hemorrhages. Cause of death: subacute nephritis with pregnancy. Contributory shock following laceration of cervix (Maner).

*Eclampsies.*—In the eclamptic series (those who had one or more convulsions) there were 103 patients, of whom 54 were General Hospital patients, and 49 outside ones, their ages ranging from twelve to forty-four years. Of these 103 patients, there were 69 primiparae. There were 50 antepartal, 25 intrapartal and 28 postpartal eclampsias.

*Mortality.*—There were fourteen deaths from all causes in the entire series, a gross mortality of 13.6 per cent. Cases 3 and 19 were early cases and did not have the treatment which is carried out at the present time. They were reported in detail in the preliminary report (AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, February, 1925).

CASE 22.—This patient recovered from her eclampsia, had a spontaneous delivery of twins, developed a puerperal sepsis from which she died three weeks postpartum.

CASE 25.—A primipara at her eighth month, had one convulsion, went into coma from which she did not come out, and died eighteen hours later without having any more convulsions. It was our impression that she had a cerebral hemorrhage but no autopsy of the brain was made. The autopsy showed typical eclamptic changes in the liver.

CASE 31.—Patient admitted in coma, had a spontaneous delivery of twins, had no convulsion after admission, and died forty hours later. Autopsy showed no eclamptic changes in liver, subacute nephritis, localized areas of bronchopneumonia, pulmonary edema.

CASE 33.—This patient, para x, eight months pregnant, had three convulsions fourteen hours before admission and remained in deep coma. On admission she was profoundly comatose; there were evidences of bronchopneumonia and pulmonary edema; she died twelve hours after admission, undelivered. *Autopsy:* confluent bronchopneumonia, fatty infiltration of liver with diffuse hemorrhagic areas in lobules, cloudy swelling of kidneys.

CASE 36.—Para i, eight months pregnant. Convulsions began three hours before admission and were not controlled until seven hours after admission; constantly deepening coma, patient died, undelivered, twenty-four hours after admission. *Autopsy*: confluent bronchopneumonia of upper and lower lobes of right lung, usual eclamptic changes in liver, acute parenchymatous degeneration of kidneys.

CASE 46.—Para i, six and a half months pregnant, first convulsion two and a half hours before admission; second convulsion one hour later, she was admitted in coma. No further convulsions. Came out of coma partially the first day, then with gradually deepening coma, she died, undelivered, five days after admission.

*Clinical Diagnosis*.—Nephritic uremia. No autopsy.

CASE 55.—Para ii, six months pregnant. Convulsions began ten hours before admission, ten convulsions having occurred; she was in coma on entrance, had one convulsion after first injection of magnesium sulphate, remained in coma, presented evidences of cerebral injury and of bronchopneumonia. Died, undelivered, twenty-seven hours after admission.

*Clinical Diagnosis*.—Nephritic uremia. No autopsy.

CASE 76.—(Outside case) Para i, eight and a half months pregnant. Admitted in post eclamptic coma, having had one convulsion; no further convulsions. Coma completely cleared in twenty-four hours. Cesarean section sixth day after recovery from eclampsia; she went into shock on table and died one hour later of surgical shock.

CASE 77.—(Outside case) Para i, eight months pregnant. Patient was admitted to hospital in labor. She developed intrapartal eclampsia, had a spontaneous delivery, death occurring four hours later, without any more convulsions. *Autopsy*: typical liver changes, severe acute renal degeneration.

CASE 79.—(Outside case) This patient was admitted in coma. Twin delivery nine hours before entrance. Convulsions began six hours after delivery. Last convulsion five hours after admission. Did not come out of coma and died thirty-nine hours after admission. Had considerable treatment other than magnesium sulphate.

*Clinical Diagnosis*.—Nephritic uremia. No autopsy.

CASE 85.—(Outside case) Para i, at term. She drank excessively of alcoholics (bootleg) during pregnancy. Forceps delivery; six hours later, convulsion, almost complete anuria first twenty-four hours; came out of coma within twelve hours, then low delirium; three and a half days later another convulsion, coma for six hours, then low delirium. She died eight and a half days after delivery. Showed high retention products values in blood chemistry.

*Clinical Diagnosis*.—Nephritis. Autopsy showed *no* liver changes; pyonephrosis, chronic interstitial nephritis with an acute hemorrhagic nephritis superimposed.

CASE 94.—(Outside case) Para i, at term. Coma and convulsions two hours before entering hospital. Spontaneous stillbirth one hour after admission. Only two convulsions in hospital, the last one, nine hours postpartum. She did not come out of coma and died three days after admission. Very high retention products values in blood chemistry.

*Clinical Diagnosis*.—Nephritic uremia. No autopsy.

✓ Of these fourteen patients who died, one (22) recovered from her eclampsia, and died three weeks later from sepsis, and one (76) died

of surgical shock from section, six days after recovery from eclampsia. These two cases should be figured as recoveries from the eclampsia. One patient (33) was moribund when she first came under observation, and two (31 and 85) were proved, by autopsy, to be straight nephritic uremias without any typical eclamptic changes postmortem.

Deducting these five deaths, there are left nine deaths in one hundred cases, a corrected mortality of 9 per cent. There were four of these nine deaths clinically nephritic uremias, but as there was no postmortem examination, we are including them in our mortality to be on the conservative side. In addition to this, the first two cases were early ones and had much other treatment, which as we have already pointed out, we felt was in great measure responsible for the outcome.

The General Hospital cases in this series naturally show a higher mortality than those from the outside because the latter were for most part private cases which had had some prenatal care, while those from the General Hospital were all what might be termed "neglected cases." Of the fifty-four General Hospital cases, 90 per cent first came under treatment from two to fifteen hours after the beginning of the eclamptic attack and were admitted in convulsions or in post-eclamptic coma. Of these fifty-four, there were eight deaths, a mortality of 14.8 per cent. In the five years immediately preceding the institution of this method of treatment, the mortality rate at the General Hospital as reported by one of us (Irwin, *California and Western Journal of Medicine*, Feb. 26) was 36 per cent. Our mortality rate, therefore, in the first year and a half of this method has been reduced about 60 per cent.

If we include the 38 cases which were definitely preeclamptic when they were first given magnesium sulphate and who did not develop convulsions, we have nine toxemic deaths in one hundred and thirty-eight cases, a corrected mortality of 6.5 per cent for the entire series.

✓ Of the 75 ante- and intrapartal eclampsias, six patients died undelivered, there were forty-eight living babies, sixteen premature stillborn and ten full-term stillborn; eight of the living babies dying of prematurity or toxemias within two weeks, so from the seventy-five patients who were delivered after treatment was instituted, there were forty living babies discharged from the hospital.

In presenting this subject at a clinic at the Los Angeles General Hospital to a group of doctors, one of us was asked, "Doctor, do you carry out this procedure in your private cases?" The answer was, "Certainly, why do you ask?" Whereupon the doctor replied, "The attacks are so terrifying to the family that they constantly importune the doctor to institute some more radical procedure," meaning

by this, a termination of the pregnancy. A study of these deaths will answer this question.

✓ Of the fourteen deaths, two were postpartal cases, one (Case 19) had a difficult forceps delivery at the height of her toxemia, one died of sepsis three weeks after a spontaneous delivery, one had a spontaneous delivery of twins immediately after admission, one died of surgical shock from section after recovery from eclampsia, one intra-partal case died four hours after an easy spontaneous delivery, one (Case 94) spontaneously delivered within an hour after admission. In none of the cases could delay in completing the delivery have been a factor in the fatality, while in one the surgical shock of the delivery was the direct cause of death, and in one, in all probability, it influenced the outcome unfavorably.

Of the six who died undelivered, one remained in deep coma and died eighteen hours after her only convulsion, one was moribund (bronchopneumonia and pulmonary edema) on admission, dying within twelve hours, one died twenty-four hours after entrance without coming out of her coma, one died on her fifth day in the hospital in a uremic coma, one died in a nephritic uremia, twenty-seven hours after admission.

Surgical termination of the pregnancy, in any of these cases, was out of the question, as it would only have hurried the fatal issue.

As to other treatment, a study of these fatal cases will show that they were the ones which had most supplemental treatment.

*Intercurrent Eclampsia.*—Lichtenstein describes what he terms "intercurrent eclampsia," in which, with conservative treatment, the eclampsia is overcome and the patient may go from several days to several weeks to delivery without recurrence of the eclampsia. In this series, of the fifty antepartal cases, there were fourteen, 28 per cent, which recovered from the eclamptic attack and went from three days to six weeks before delivery without further eclampsia.

Of these fourteen cases, two were discharged undelivered and re-entered the hospital fifteen days and twenty-two days, respectively, after eclampsia, and were spontaneously delivered; four had induction of labor because of persistence of toxemic symptoms (no eclampsia); three had sections (no general hospital case), and five had spontaneous labors.

One case (47) was of particular interest. This patient was admitted to the hospital eleven hours after onset of convulsions, which had recurred hourly during the day; she had been in coma continuously since first convulsion and was at her thirty-second week of pregnancy. Two injections of magnesium sulphate controlled the convulsions and she was carried six weeks without recurrence of eclampsia to the spontaneous delivery of a living baby.

Of the sixty-seven cases delivered after the treatment was instituted, there were forty-seven spontaneous labors, ten forceps extractions, three versions, one breech extraction, eight bag inductions and eight cesarean sections.

There has been but one cesarean section on an eclamptic patient at the General Hospital since we began the intravenous use of magnesium sulphate. This patient (Case 53), para i, had been in labor twenty-four hours before admission, the os was dilated to 4 cm. and the head was high above the inlet of the pelvis. While she was being examined, immediately after entrance, she had her first convulsion. She had three injections of magnesium sulphate before being operated upon three hours later, the cesarean section in this case being done for the dystocia and not because of her eclampsia.

Of the seven outside cases which were sectioned, one (Case 68) was operated upon for a cardiac decompensation, convulsions developing after the operation; one (Case 88) for a preeclamptic toxemia, convulsions developing after the operation; four (Cases 16, 56, 76, 90) after the convulsions and coma were entirely cleared, and one (Case 83) during the eclamptic attack, so that of the eight cesarean sections, only two were done during the eclamptic attack and both of these because of dystocia.

The rationale of the intravenous magnesium sulphate treatment of eclampsia is as follows: As stated in the preliminary report, our first idea was to control the convulsions by the sedative and anticonvulsive effect of magnesium sulphate as was first demonstrated by Meltzer and Auer. "In addition, eliminative measures, such as phlebotomy, stomach lavage, administration of castor oil, colonic flushings with glucose and soda were carried out as in the treatment of any toxemic condition." It was very soon noted that there was apparently a marked eliminative effect, evidenced by the diuresis produced, the rapid subsidence of the edema and improvement in the toxemic condition.

This eliminative effect, we thought to be due to the dehydrating effect of the intravenous magnesium sulphate. The tissue fluids are drawn into the blood stream, thus reducing the edema, and by increasing the aqueous content of the blood, diuresis is increased, overcoming acute kidney block and relieving the toxemia. The coma clears up more rapidly because of the reduction of cerebral edema (intracranial tension). Further experience has confirmed to our minds these deductions.

A study of the case records also seemed to show that where additional eliminative measures (lavage, phlebotomy, hot pack, etc.) were vigorously employed, the convulsions were more difficult to control

and, in two of the General Hospital cases, apparently were factors in the unfavorable outcome.

In this regard, the third conclusion of the preliminary report ended as follows: "However, as our confidence in the magnesium sulphate has increased, we have gradually reduced this supplementary treatment until, in the last two cases, little else was done." Since then, in the treatment of the toxemias at the Los Angeles General Hospital, we have eliminated practically all other measures, depending entirely on the magnesium sulphate. That our confidence was not misplaced is proved, we believe, by the analysis of our cases.

The following routine is posted as a guide for the resident staff at the Los Angeles General Hospital: Preeclamptic cases with blood pressure 150 or higher, in addition to the usual sedative and eliminative treatment and dietary regulation, 20 c.c. 10 per cent solution magnesium sulphate intravenously; blood pressure to be taken twice daily and intravenous magnesium sulphate repeated if blood pressure does not come down. Surgical interruption of the pregnancy only to be done with the consent of senior attending obstetrician. In eclampsia, 20 c.c. 10 per cent solution magnesium sulphate intravenously as soon after first convulsion as possible, to be repeated every hour until convulsions are controlled (attending obstetrician to be notified if convulsions are not controlled within three hours). Blood pressure to be taken every hour after the convulsions are controlled and if blood pressure begins to rise, again nearing its height at time of convulsion, repeat magnesium sulphate; also repeat if convulsions recur.

If patient is comatose or very restless in a semicomatose delirium and blood pressure is falling, give chloral hydrate, gr. 20, and sodium bromide, gr. 40, *per rectum*. All patients to be prepared for delivery as soon as they are quiet enough to do so.

Utmost quiet to be observed and nurse to be constantly with patient until coma has cleared. Oxygen inhalations after each convulsion until breathing is normal. If patient is in labor, give nitrous oxide gas for pains. If in second stage labor and proper progress is not being made, low forceps extraction or version may be done with consent of attending obstetrician. *Cesarean section only to be done for absolute obstetric indications and with consent of senior attending obstetrician.* After patient is delivered, blood pressure to be taken daily and intravenous magnesium sulphate to be repeated as indicated by rise of blood pressure.

All patients on discharge are referred to the medical clinic for thorough examination, in order to eliminate any possible local focus of infection which may have acted as an exciting cause of the eclamptic attack.



*Reactions.*—The reactions to the intravenous injection of magnesium sulphate have been mild, except in one instance, and all rapidly pass off. The one reaction noted was in a cardiac patient with decompensation, who developed eclampsia after delivery (by section). The doctor reports "severe systemic reaction, cyanosis; short jerky respiration which cleared in about fifteen minutes. No more convulsions." This patient made a recovery.

The preeclampsies all complain of a feeling of warmth when the injection is given; occasionally there is nausea and vomiting, this especially if injection is given shortly after a meal; in a few cases, there were chills followed by a rise in temperature, in one case to 104° F., all of which rapidly cleared.

In the past year there have been a few reports from other clinics which have used magnesium sulphate intravenously.

H. J. Stollenwerck, of Jacksonville, Florida, in a personal communication, reports six cases in which this treatment was carried out. These cases are included in this series.

J. O. Arnold, of Philadelphia (*The American Physician*, December, 1925), reports the intravenous use of 20 c.c. of 10 per cent solution magnesium sulphate in conjunction with phlebotomy. He reports twelve cases, with recoveries in all.

S. Berman, of the Boston Lying-In Hospital (*Boston Medical and Surgical Journal*, Jan. 7, 1926), says, "We have used the magnesium sulphate solution in several cases and thus far the results have been very encouraging. The patients become restful and the urinary output increases. The convulsions do not cease entirely but come less often. We believe it a worthy adjunct to our present method of treatment and deserving of a fair trial."

#### CONCLUSIONS

1. Intravenous administration of magnesium sulphate in sufficient dosage will prevent the development of convulsions and will control them after their onset.

2. A series of eclampsies is presented which, under the intravenous magnesium sulphate treatment, shows a corrected mortality of 9 per cent.

3. The true nephritic type shows the greatest mortality.

4. Surgical interference in the eclamptic should be limited to assisting labor (in the second stage) on definite obstetric indications.

5. Cesarean section in the eclamptic is contraindicated except in the presence of absolute obstetric indications.

Our thanks are due Dr. G. D. Maner, Pathologist at the General Hospital, and Dr. A. H. Zeiler for autopsy reports; to the various doctors who reported cases to us or allowed us to review their case records, and to our associates on the attending obstetric staff of the General Hospital for their cooperation in the work.

## BREAST CANCER METASTASIS\*

BY W. A. COVENTRY, M.D., F.A.C.S., DULUTH, MINN.

*(From the Duluth Clinic)*

WITH the year 1919, when the medical literature contained a large number of references to the use of the roentgen rays, both in pre-operative and postoperative cases of cancer of the breast, dissatisfied with the results obtained, I began to keep a more accurate record of all cases operated upon by myself as well as by several of my colleagues. We were all of the opinion that possibly the use of roentgen rays would tend to cure, to promote longevity, or to delay the fatal results in cancer of the breast. I frankly state that previous to 1919 I was discouraged with the results. At the present time I am more discouraged at the results of the so-called "cure" of breast cancer cases which have been operated upon by myself and by colleagues. A careful study of these cases has also brought forcibly to our attention the many avenues of metastasis that may occur in breast cancer.

Of the ten women operated upon in 1920, eight are dead and two are living but have recurrences.

Of the seven operated upon in 1921, five are dead; one has recurrences, and one is living and well.

Of the nine operated upon in 1922, eight are dead; none have recurrences, and one is living.

Of the eight operated upon in 1923, two are dead; two have known recurrences; four are living and well.

Of the seven operated upon in 1924, four are dead; three are living; none have recurrences.

Of the six operated upon in 1925, one is dead; four are living; one has recurred.

This totals forty-seven cases in the five-year period. Twenty-eight, 60 per cent, are dead. Four, 9 per cent, are living with known recurrences; fifteen, 31 per cent, are living. Of the fifteen living, eleven were operated upon within a two-year period. Of those in the five-year period all are dead or have recurrences.

All deaths were due to cancer metastasis, except two, one due to lobar pneumonia, which we were unable to prove had anything to do with metastasis, and one due to a long-standing diabetes.

Of those living who have recurrences, carcinoma developed in one

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\*Read at the Thirty-eighth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, held at Hot Springs, Va., September 16, 17, and 18, 1925.

in the skin on the operated side; in two, in the opposite breast; in two, in the supraclavicular glands of the neck, and in one, in the spine.

Fortunately there are a few still living without any signs of recurrence, but the five-year period has not yet passed for them.

A review of these statistics is not encouraging.

In all of these cases the radical operation was employed with two exceptions. By "radical" I mean removal of the pectoral muscles, major and minor, wide areas of skin and breast tissue, of the fascia down to the ribs and that extending up to the clavicle, of the axillary glands and gland-bearing area. I believe the skill exercised in the removal of these breast cancers was of average type.

Eighty per cent of the cases had a preliminary treatment over the breast and the gland-bearing area in the axilla with roentgen rays, the average dose being five milliamperes, 100 kilowatts, 9 inch gap, 10 inch focal skin distance, 5 mm. aluminum filter, and 15 minute treatment.

Operation was then done at varying periods from two days to one week following the initial radiation.

Ninety-five per cent of all cases have had postoperative x-ray therapy, the treatments varying from two to as high as twelve, in varying periods, from two to three weeks apart. In some, the dose has not been as great as in others, but the standard dose already noted has been attempted. Full treatment was not given those patients who suffered from marked nausea and so-called "x-ray sickness." In fact, this dosage of x-ray was decidedly disagreeable to many of the patients, and it was only by the greatest persuasion, and, of course, the hope that the treatment would be highly beneficial, that we were able to prevail upon many to continue the treatment.

Never before have we observed such apparently rapid metastasis, and metastasis into so many portions of the body as this little study has revealed. Our observations on metastasis have confirmed those of Handley as to the avenues of invasion.

Our series show that 95 per cent had axillary involvement before operative interference. These patients, however, were operated upon, the operator being well aware of the fact that much has appeared in the literature advising against removal when the axillary glands are involved. I am, however, certain that if the axillary glands are involved, one may at least attempt operation. We have observed that in those with axillary involvement that were followed with x-ray treatment, especially into the axilla and over the breast area, only 2 per cent of the patients have had recurrences in the axilla of the side that was operated upon.

There were four cases in which there was metastasis into the clavicular group of glands, either subclavicular or supraclavicular. The more recent literature tells us that these cases should not be operated

upon under any circumstances. Our observations have led us to believe, although we have operated upon these cases, that not to operate is much better than to operate, because these cases in which we have found supraclavicular glands, in spite of the intensive x-ray treatment, have rapidly progressed and shown metastasis elsewhere, as well as in the supraclavicular region.

Metastasis through the chest wall to the mediastinum and lungs has been observed in only two cases. There were, however, cases in which there was lung involvement demonstrated, and whether they were primary through the chest wall, or whether they were due to malignant emboli or metastasis from some other source, we were not able to determine. We had one case, however, in which there was known metastasis through the pleura.

Carcinoma in the opposite breast occurred in two cases of the series, one of these being in a nursing mother.

In four cases carcinoma later developed in the liver, but these were also associated with metastasis to other parts, so we have been unable to determine whether the liver involvement was secondary to the breast involvement, or whether it was secondary to a metastasis that already had taken place in other parts of the body.

Local recurrence in the skin has occurred in only one case. Our observation previous to 1920 showed that local recurrences to the skin occurred comparatively frequently, but I am of the opinion that the treatment with x-ray has undoubtedly retarded the occurrence of metastasis in the scar or in the skin over the removed area.

Metastasis in the skeletal bones, especially the spine, the pelvis, and the heads of the femurs, have been most prominent in this series.

Pain in the hips, in the pelvis, or in the back after an operation for carcinoma, even before definite evidence can be found by x-ray, is a very characteristic sign of metastasis. This pain is very persistent and intense. More particularly is this true in cases of spinal metastasis. The frequency with which metastasis into the skeletal parts has been observed in this series, certainly leaves the impression that our use of x-ray seems to have scattered metastasis to remote parts rather than to have retarded it, as we had hoped it would do.

In the order of frequency, metastasis has occurred in the head of the femur, the ileum, spine, sternum, the ribs, skull, and the lower jaw.

We have not yet seen a case of metastasis in the skeleton below the head of the femur.

The treatment of metastasis, especially of the skeletal parts, by the use of x-ray, has not been satisfactory. Prompt and better results are recorded by the use of the high voltage dosages, when the pain is said to be relieved and the disease somewhat retarded.

Metastasis into the skeletal parts can only be determined by repeated x-ray pictures of the parts suspected of involvement, and in the early stages only by the closest scrutiny.

It is generally agreed that the degree of malignancy in carcinoma is due to the type of cell found in the tumor. Tumor masses showing hyalinization and fibrosis generally speak for longevity, while those cells of a more embryonic type speak for a shorter life. The unknown quantity of the degree of resistance of the patient must also be taken into consideration. These facts have been well shown by McCarthy and Sistrunk in a very admirable work. It is generally recognized that the size of the tumor in the breast is of no particular prognostic value, but that the involvement of palpable glands, with fixation, decreases the chances more than one-half for a favorable outcome.

All of the cases operated upon and reported here have had pathologic examinations by competent pathologists. Those found to be of the scirrhous type have lived longer than those in which there was marked mitosis.

With experience, one comes more to believe that it is much better to give the patient the benefit of the doubt and remove all fibromas and cystic mastitis, so-called "lump in the breast"; this is a much safer procedure than to allow them to remain until a gross diagnosis of cancer can be made.

Also, one may come to this conclusion: In view of the fact that when metastasis has taken place even into the axilla, cancer, although one may operate and use all precautions known, has undoubtedly spread beyond the control of the surgeon, and one cannot help but feel that these patients would be far better off without operation.

Our observations show that, in view of the fact that skeletal metastasis is so common and when once found the prognosis is hopeless, it is better practice in all cases of breast carcinoma to take roentgen pictures of the ileum, head of the femur, and the spine, so as to determine before operation whether there is any metastasis in these parts. If metastasis is found, it would be very much better to refuse operation and to attempt to treat palliatively; I feel sure that the ultimate outcome would be as favorable, if not more so, and that life would be prolonged by such a procedure.

Our observations also convince us that the use of x-ray preoperatively and postoperatively certainly has not shown the results that were hoped and expected of it, when this series began.

*(For discussion see page 122.)*

# Department of Maternal Welfare

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CONDUCTED BY FRED L. ADAIR, M.D.

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## THIRD ANNUAL CONFERENCE OF STATE DIRECTORS OF MATERNITY AND INFANCY WORK

*Held at Washington, D. C., January 11 to 13, 1926*

**R**EPRESENTATIVES were present from forty-one cooperating states and three states not cooperating with the federal and state activities. A program had been arranged by a committee of directors (appointed at the previous conference) working in conjunction with the Children's Bureau. Papers were presented by various authorities in their respective lines, and also by directors who had made a special study of or had valuable experience along certain lines, mostly in regard to the administrative side of the work.

DR. FRED L. ADAIR, of Minneapolis, read a paper on **The Physician's Part in a Practical State Program of Prenatal Care**. (Will appear in the August issue.)

DR. ROBERT L. DENORMANDIE, of Boston, presented the **Standards of Prenatal Care**, intended for physicians in private practice and in clinics. (Will appear in the September issue.)

MISS CAROLINE VAN BLARCOM discussed **The Nurse's Part in a State Program of Prenatal Care**.

The general work of the nurse is to assist the physician in carrying out the prescribed details of supervision, instruction, and care of expectant mothers, and to work toward the ideal of having every expectant mother under medical care from the beginning of pregnancy. She must cooperate with the physician to reorganize and regulate everyday lives of the expectant mothers in his care, and is responsible to him, because all her work is an interpretation and exact application of medical teaching. She must inspire in her patients a confidence which will lead them to follow consistently her advice and instruction on details that the physician wishes them to know about but which he rarely has time to dwell upon for each patient as often and as long as he would like. She is responsible to the community, because her service is of public importance, the future welfare of the race depending upon the aggregate of such work as hers. She should know of the high maternal and infant mortality and the impairment of health of mothers and babies who do not die, both due, to a certain extent, to preventable conditions associated with childbirth. She must know the physiologic changes of the process, the earliest and mildest symp-

toms of danger, and the importance of immediate treatment for them. She must record each observation made at each visit to the patient. If she is to take temperature and blood pressure and do urinalysis, the requirements must be rigid, all symptoms must be noted and reported promptly, and such intangible symptoms as depression, unusual fatigue, even carelessness, as an indication of fatigue, must be observed. The patient must be taught how to care for herself, what changes to expect, what symptoms to note, how to prepare the baby's outfit, and how to prepare for delivery. Most maternity patients are still cared for in their own homes, and demonstration of clothing and other needed equipment is better than verbal description. The nurse's ingenuity may be taxed to help produce the results needed, yet she must remember that the requirements of all expectant mothers are the same, no matter how their financial and social levels may interfere with the attainment of them. Lastly, the nurse must clear up the varied fears and mental obstacles which are in the minds of most patients, and replace them by a joyous anticipation of the baby that is to be born.

DR. HENRY SCHULTZ, of Chicago, read a paper on **Statistical Studies and Graphs**.\*

DR. ROBERT L. DENORMANDIE read a paper entitled **How to Make a Study of the Causes of Maternal Mortality**.

The international list of causes of death is to be followed, thus including all deaths of women, due more or less indirectly to childbearing.

Not to be classified under the puerperal state are deaths of pregnant women from criminal abortion, an accident which in itself is enough to cause death, long-standing chronic disease, such as tuberculosis or cancer, and acute infectious disease (except influenza).

Whether or not all puerperal deaths are so recorded depends upon the classification made by the attending physician. The word puerperal should be added to the death certificate whenever a death occurs during or following pregnancy. Physicians are not always accurate on this, as appears whenever the deaths within the childbearing age are checked up against the birth returns in a period under study.

From the registrar of vital statistics must be ascertained the woman's name, home address, place of death, certification of cause of death, and the name of the physician in charge. The physician must then be visited and further information sought. For most cases there will be no history, no record of the cause of death, no temperature charts, nothing but the physician's memory, to recall details of a death which may have occurred many months before. If possible, the number, character, and outcome of the woman's previous pregnancies, her past medical history, and the kind of prenatal care received during her last pregnancy should be learned. The kind of delivery, the vaginal examinations made, the technic of the physician, and, for an operative delivery, the length and type of labor, the operation performed, and whether or not pituitrin was used should be ascertained.

Assembling, tabulating, and analyzing these facts should aid in determining where the responsibility for maternal death lies, or, in other words, in determining whether any of these deaths are preventable. Sepsis and puerperal albuminuria cause about 65 per cent of the deaths from childbirth; and the responsibility for sepsis lies with the attendant at delivery in most of the cases.

\*This, as well as other papers presented at the meeting, can only be announced by title in the Journal because of lack of space. They may be found in No. 157 of the Publications of the Children's Bureau.

DR. JULIUS LEVY, of Newark, N. J., discussed **Midwife Classes.**

New Jersey, with a population somewhat more than 3,200,000 has about 3,000 physicians, 69 large general hospitals with free clinics, and about 30 small private hospitals and maternity houses, one county having no hospital of any kind. The State Board of Medical Examiners has control of the licensing and suspending and revoking of licenses of midwives. The Child-Hygiene Bureau has been interested in supervising midwives, because this has seemed essential and necessary for the proper protection of child life. The midwives not only attended about 42 per cent of all the births occurring at the time the bureau began work but also exerted a highly important influence upon the survival of the infant, the mother's attitude toward it, and the care to be given it.

It has seemed most economical and efficient to place in a limited area one nurse who would be responsible for work touching all the important factors entering into the life of the child and certain related activities. The next step was to have district supervisors of nurses, each to direct the activities of as many nurses as she could well supervise, and to supervise also the work of the midwives in the respective districts. An assistant in the central organization bears the responsibility for the field work of the district supervisors in regard to midwifery. In 1919 the bureau had one supervisor who covered two counties. In 1925 there were 12 working in the 21 counties of the State. In 1919 there were 946 licensed midwives, of whom 450 were active, and 262 midwives were practicing without a license; they delivered 42 per cent of the births. In 1925 there were 398 licensed midwives and 11 unlicensed (all of whom have been referred to the State Board of Medical Examiners for prosecution), and they delivered 23 per cent of the births. The lower percentage of births delivered by midwives is probably to be ascribed to the restriction of immigration, as well as to their supervision.

In 1919 the midwives hardly knew that the law required them to use silver nitrate in the eyes of the newborn, and cases of ophthalmia neonatorum were frequent. In 1925 it was shown that 98 per cent used this solution, and ophthalmia of a gonorrheal nature is now almost unknown in the State. In 1919 about 32 per cent of the midwives carried a spare bag and equipment. In 1925 good bags with equipment exactly as required by the bureau were carried by 87 per cent. This is a result of inspection of the bag in the home as the midwife uses it. In 1919 it was found that 21 per cent of the midwives carried various instruments and prescribed drugs. In 1925 it is rare that any give a hypodermic or prescribe a cathartic pill. They have learned to read and use clinical thermometers, and 80 per cent used them regularly in 1925. Physicians are called by 77 per cent of midwives for cases showing any abnormality in pregnancy, labor, or the newborn infant, a form for this being supplied.

The district supervisor gives an estimated proportion of one-fourth of her time to the midwife work, visiting the midwives directly, visiting prenatal cases reported to them, and investigating puerperal deaths, infant deaths, and stillbirths in order to have detailed information in regard to midwives' methods.

It has been pointed out to the midwives of Newark that inasmuch as the deaths of infants under one month of age constitute about one-half of the deaths under one year of age, and the deaths under one week constitute about one-fourth of the total, it would be desirable to get a record of the births the day the babies are born. A postal card blank for name, date, and address of the birth, addressed on the other side to the State department, was printed for the midwives' use. The fact that today these cards are being received within twenty-four hours of the birth for about 90 to 95 per cent of all babies delivered by midwives in Newark would indicate what can be done through active cooperation with the midwife.



DR. MARTHA M. ELIOT described a **Demonstration of the Community Control of Rickets**. (This is an important obstetric problem.)

DR. ALICE WELD TALLANT, of Philadelphia, discussed the matter of **Informing the Medical Profession in Regard to Maternal and Child Welfare Work**.

MISS NINA SIMMONDS spoke on **Nutrition in Relation to Reproduction and Vitality of the Offspring**.

It has been noted in regard to humans that a mother producing much milk is not necessarily producing good milk. Unless she has a satisfactory diet her milk is of poor quality. A number of examples were cited. The prevalence of osteomalacia is noted in Manchuria and the Shansi province where the diet is low in mineral content and in vitamine *D*. This is especially common among women during puberty, pregnancy, and lactation, the calcium supply in the bones being drawn upon when the need for calcium salts is greater than the intake in the food. Addition of calcium to the diet does not make good the deficiency; good food, cod-liver oil, and sunlight are needed to aid in its assimilation.

The diets of the pregnant and nursing mothers are of the greatest importance for the well-being of the child, but it is shortsighted to wait until a woman is pregnant before taking note of her diet. Faulty diet may interfere with fertility, prenatal development of the young, secretion of milk of satisfactory quality, and development of skeletal tissues of the nursing young. It may cause in the mother very damaging nutritional disturbances and sometimes extreme and permanent injury.

MR. WILLIAM M. CHENERY read a paper entitled **How Can Popular Magazines Aid in Campaigns to Reduce Infant and Maternal Death Rates?**

An editor must publish what the people will read. If he does not, his magazine goes into bankruptcy, for his mistakes in regard to what the readers wish are revealed in red figures submitted by auditors. All newspapers and magazines operate under this compulsion, the newspapers having the advantage that they can appeal to several audiences, whereas a magazine has but one to which to appeal, and it must calculate on winning the interest of at least 60 per cent of that audience. Consequently any campaign for the reduction of maternal and infant mortality must be related to the interest of large groups of people. In order to do so the campaign must not remain abstract but must be translated into terms of individuals, and be expressed in the story of the fortunes or misfortunes of real or fictional persons in such manner that the reader feels a bond of sympathy. Another method of lesser value is to relate the material to something in which the reader sees utility for himself, as is done, for example, in the service columns of the women's magazines especially, and in newspapers. A third method is the announcing, when possible, of some new principle or general truth containing an element of novelty, such as the idea that poverty has a universal relationship with infant mortality, which seems to be the inevitable conclusion of certain studies in regard to infant mortality which the Children's Bureau made some years ago. Since the great majority of the public do not appreciate the value of scientific work that is being done, or even know that any is being done, there is an actual obligation on the part of the scientific workers to have at least a share of the results of their labors translated into a medium which the general public can understand.

DR. WM. H. DAVIS read a paper entitled **Stimulation of Birth Registration.**

Nearly all the states have good registration laws (12 are not yet in the birth-registration area), but the laws are not well enforced in all. Imperfect enforcement may be due to inadequacy of appropriations for clerical help and field agents to assist state registrars; to carelessness, indifference, or actual hostility on the part of physicians, midwives, and parents; or to the fact that the state registrars may be too lenient and delay prosecution in the hope that persuasive measures will suffice. The lack of a uniform policy in regard to prosecutions is one of the greatest drawbacks to good registration at the present time. In Pennsylvania where, as in many other states, the physician must report each birth within ten days, the child's rights are preserved, even if the physician fails to report the birth; this is done by the requirement that the physician must file an affidavit giving the reason for delay in filing the original certificate and swearing that the facts thereon are true and correct. If he objects to filing the affidavit he has the alternative of going into court, where conviction may cost him \$50 to \$100. Many excellent devices are used to stimulate complete and prompt birth registration; 32 states send out to mothers a notification of filing of the child's birth; posters urging registrations are prominently displayed; and educational work is done in various ways by the Census and Children's Bureaus, and also by workers in the maternity and infancy field, and others. It is hoped that by 1930 every state will be in the birth-registration area.

# Society Transactions

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## AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS AND ABDOMINAL SURGEONS

THIRTY-EIGHTH ANNUAL MEETING

HOT SPRINGS, VA., SEPTEMBER 16, 17 AND 18, 1925

DR. ASA B. DAVIS, OF NEW YORK, PRESIDING

*(Concluded from May)*

In a Symposium on **Malignancy**, the following papers were read:

**Sarcoma of the Stomach**, by DR. GEO. F. CHANDLER, KINGSTON, N. Y.  
(See page 101.)

**Metastasis in Breast Cancer**, by DR. WM. A. COVENTRY, DULUTH, MINN.  
(See page 113.)

**The Differentiation of Cancer Tissue**, by DR. JAMES E. DAVIS, DETROIT, MICH. (See page 29.)

### DISCUSSION

DR. HENRY SCHMITZ, CHICAGO, ILL.—To correctly evaluate the treatment, the cases should be grouped as we group the cases of carcinoma of the cervix, namely, Group 1, the clearly localized cases; Group 2, comprises cases in which there is doubt about localization to primary seat of invasion; Group 3, contains the cases with invasion of the contiguous tissues and organs without fixation, and Group 4, those with a fixation and extensive invasion. The same classification could be applied to the breast cases. The indications for the various methods of treatment are placed on this grouping.

In Group 1 the treatment indicated is radical excision, including the pectoralis muscles. There is no necessity of applying the x-ray or radium because all the cancer cells can be removed and the patient should remain well. In Group 2 there is a tendency of the carcinoma to spread, there is usually a very perceptible growth. Here x-ray should first be applied in a sufficient dose to cause occlusion of the lymphatic vessels and a degeneration of the cancer cells, so that they are for the time being stunned and rendered harmless. Operation then follows. In Group 3 we should primarily have recourse to radiation and if, after radiation, the carcinoma becomes movable and reduced in size, then we should add a radical excision. In Group 4 no form of treatment will do the patient any good.

It is, of course, natural that in the treatment of carcinoma of the breast we should pay particular attention to the mode of spread by metastases. We know that the spinal column, the hip bones and the heads of the femurs are the places most frequently involved, even after extensive primary treatment. Therefore x-ray pictures should be taken of every case of cancer of the breast before treatment. In recent correspondence I have had with Dr. Bloodgood about the matter we came

to the conclusion that if x-ray treatment can do these patients any good, the bones of the entire trunk should be included in the treatment to prevent the appearance of metastasis later on. If we wait until metastases occur, which are usually indicated by indefinite pains in the involved areas, x-ray treatment rarely will do the patient any good.

I have treated a great many carcinomata of the breast and recorded 180 cases which had been treated more than five years ago. They were divided into two classes, the primary and the recurrent carcinomas. Of all the cases of primary carcinomata, about 28 per cent have passed the five year period free from recurrence; of the recurrent cases 20 per cent have passed this period. I do not wish to say these cases may not eventually die from carcinoma, but they have passed the five year period well and free of the disease.

It has been stated that the so-called high voltage radiation will give better results than the low voltage, the essayist having used a 100 kilovolt current. It does not make any difference what kind of radiation one uses so long as the radiation is absorbed in the diseased tissue, and the 100 kilovolt will give as good results as the 200 kilovolt. We use both kinds of apparatus in Chicago and in carcinoma of the breast we decline to use the 200 kilovolt current because the results were very inferior to those obtained with the 100 kilovolt. The high voltage on account of deeper penetration will cause more damage to the lungs than the 100 kilovolt.

If I have any criticism to offer it is that the focus skin distance was too short and therefore the difference in intensity between the surface dose and the deep dose at 2 or 3 cm. was so great that the underlying cancer tissue received only a fraction of radiation, which in this instance was probably about 25 per cent. If a greater focus skin distance had been used—say 50 cm. or even 65 to 80 cm.—and a 100 kilovoltage, I believe the results from the x-ray radiation would have been better.

It was stated that some of these patients had received x-ray treatments at frequent intervals, as often as at twelve different times. Normal tissues will recover from the damage caused by x-rays after one application, and probably also after a second application. But if the application is continuously repeated we will cause a degeneration of healthy tissue, such as indurations and ulcers, which behave like a malignant disease. Therefore, we should make it a rule not to subject the patient to repeated x-ray treatments. If results are not obtained by one or two correctly applied radiations then the cancer is refractory and further applications are useless and dangerous.

The microscopic study by Dr. Davis is a very valuable contribution. If we apply his teaching method we will materially contribute to the correct diagnosis of cancer. The work done by Alter, Martzloff, Schottlaender and Broders in the study of the cell type of cervical carcinomata has greatly advanced our knowledge of the malignancy of cancer. Such typing should be made the foundation for treatment. A fat spindle cell, unripe carcinoma is much more malignant and resists treatment much more than the prickle cell or squamous cell cancer. The latter shows a higher percentage of five year healing after operation and also radiation than the fat spindle cell type.

DR. WM. W. BABCOCK, PHILADELPHIA, PA.—I speak with hesitation about a treatment we have used in apparently hopeless cases of malignancy during the past eighteen months. The principle is not new, is based upon the work of Dr. Hodenpyl and consists in injecting intravenously ascitic fluid from patients with cancer of the peritoneum. We have used very large injections—250 to 2,000 c.c.—and have found the fresh peritoneal fluid from other patients with carcinoma very well tolerated. Almost eighty injections have been given; the total number of patients being about forty. In two patients surprising improvement has followed the treatment.

A man found on an exploratory operation to have an apparently inoperable carcinoma of the stomach and considered hopeless, was given one injection and sent home to die. He soon gained 27 pounds, lost all symptoms and now has been back at work for a year and seems to be in good health.

The second case is that of a woman who was operated upon last year for advanced cancer of the uterus and then treated for recurrence by radium. The disease progressed, she developed a large fistula in the bladder and last Spring was finally confined to her bed under opiates. The condition was such that further treatment by radium was refused. After several injections, she showed surprising improvement both locally and generally.

Recently, she reported at the office, having the fistula but with little induration and no odor or bleeding.

The other patients treated have for the most part died. The fluids have been from various types of carcinoma involving the peritoneum with ascites. Here is a method of giving richly albuminous fluids in large amounts to replenish the tissues of the debilitated patients with carcinoma. To avoid reaction we have found blood and fluid typing less important than the use of fresh ascitic fluid.

DR. WM. SEAMAN BAINBRIDGE, NEW YORK CITY.—You may recall a report, previously made, of a series of cases of malignancy (a large number of which were in animals and a lesser number in humans) where hypodermic and intravenous injections of fluid were administered. There were about two dozen, not counting about twenty-five controls, in which we used hypodermics of saline, albumin, and various other fluids. As is true in many cases of advanced cancer, which may get better and then worse, regardless of the type of treatment used, we had temporary improvement in many of these cases. In some instances, we used ascitic fluid, while in others we used quite different fluids, and about as many patients showed this temporary improvement under the injection of the one fluid as under the other. All of the cases, however, eventually died, the course of their disease being unaffected by the treatment. Our experience with the Hodenpyl serum and its usefulness has been published.

DR. MILES F. PORTER, FORT WAYNE, IND.—I should like to ask the author of the paper on sarcoma of the stomach to tell us what these patients died of who lived from two to seven years? I would like to ask also regarding the metastasis to the liver by way of the lymph glands. Sarcoma does not usually metastasize in that way. What is the explanation?

A word regarding radiation in the attempt to cure cancer. I can recall three individuals who have died as a result of fibrosis of the lungs consequent upon, in my humble opinion, the use of the x-ray in extensive doses in the attempt to prevent metastasis from a carcinoma of the breast.

I should like to ask also how the diagnosis of the cancer, cured temporarily at least by the injection of the peritoneal fluid, was made? I at one time reported five consecutive cases of cancer of the thyroid. This diagnosis was made in the laboratory and the cases were cured by subtotal thyroidectomy. The explanation is that the diagnosis was wrong.

DR. CHANDLER (closing).—I cannot answer Dr. Porter's question because in all the literature there is nothing I can find on the subject. I am watching this woman and if I live long enough I will know what causes her death eventually. I have had a number of my colleagues look over these cases and there seems to be nothing that states what the patients die of. All the pathologists say that the metastasis in carcinoma of the stomach is through the lymphatics into the liver. I cannot explain it.

# THE NEW YORK OBSTETRICAL SOCIETY

MEETING OF FEBRUARY 9, 1926

THE PRESIDENT, DR. O. PAUL HUMPSTONE, IN THE CHAIR

## DR. P. H. WILLIAMS reported a case of **Rupture of Uterus Through Previous Cesarean Scar.**

Mrs. M. M., was operated upon August 17, 1922 in my service at the Lincoln Hospital. A classical, high incision, cesarean section was done because of generally contracted pelvis, a large fetus, and a pedunculated subserous fibroid about 7 cm. in diameter attached to the anterior wall of the uterus.

The operation was uncomplicated and the fibroid was removed. The uterus was sutured with a row of chromic gut sutures, including peritoneum and muscle down to endometrium, after a second row including the muscle alone had been inserted and tied; and followed by a continuous Lembert suture of plain catgut, covering the uterine incision with peritoneum. The abdomen was sutured in layers.

She made an uneventful recovery, except that there was a slight infection in her abdominal wound, and a rise of temperature to 104° F. on the fourth day. She left the Hospital in twelve days, with a healthy baby.

The following winter her doctor informed me that she was pregnant a second time, and I advised him to keep close watch of her, and to send her to the hospital promptly at the onset of labor.

On June 2, 1923, the patient telephoned me that she had no pains, but had felt for a few days a soft swelling in her abdomen. I advised her to go immediately to the hospital, and on the following day found, upon examination, that the uterus contained a full-term fetus in R. S. A., the head in the upper right quadrant, the presenting breech not engaged, the cervix rigid, long and undilated. A cystic mass which disappeared upon firm pressure and became more evident upon uterine contraction appeared at the umbilicus, behind which could be felt a firm hard ring, especially between contractions.

The patient had had no pains, and there were no signs of the onset of labor. An immediate operation was decided upon.

Incision was made to the right of the former scar. Upon opening the abdomen a cystic mass filled with semitransparent fluid presented itself, giving the appearance of a thin-walled unilocular ovarian cyst, but on pressure some of the fluid disappeared revealing a fetal arm, forearm and hand in the cyst. There was no blood nor bloody fluid in the abdominal cavity. In handling, the cyst was ruptured, with the escape of amniotic fluid through the abdominal wound. The ring-like scar was incised above and below, a full-term fetus removed and a supravaginal hysterectomy performed.

The abdomen was sutured in the usual way, and the patient made an uneventful recovery.

Upon examination of the uterus, the edge of the hole showed no roughness, no granulating area, and no signs of hemorrhage, and the endometrium seemed continuous with the peritoneal covering of the organ. The rim was of cicatricial hardness and was much less elastic and compressible than the surrounding uterine muscle.

The points which I wish to emphasize are: (1) there must have been a separa-

tion in the uterine wall and a herniation of the amniotic membranes at least forty-eight hours before the patient's admission to the hospital, without any contractions of the uterus, except the normal Braxton-Hicks phenomena; (2) there was no blood in the peritoneal cavity, nor other signs of a sudden rupture; (3) the tumor was the only thing noticed by the patient, who never complained of any pains, such as signalize the onset of labor.

### DISCUSSION

DR. A. B. DAVIS.—I recall that about twelve years ago a patient was admitted several days before the calculated full term for her second cesarean delivery. Upon examination a very large fluctuating mass, at first thought to be an ovarian cyst, was found. It was decided to deliver this case by section without waiting for the onset of labor. Upon opening the abdomen a full-term fetus was found floating in the amniotic sac, the mass which had been taken for the ovarian cyst. The uterus, containing the placenta and fetus, had ruptured and contracted well down toward the pelvic brim. There was no evidence of blood, and the membranes were adherent to the edges of the uterine wall where rupture through the old cesarean scar must have occurred months before. To all intents we were dealing with an abdominal pregnancy with the placenta lodged in the uterus. The placenta was manually extracted; the edges of the old cesarean wound were freshened, and the opening was closed in layers in the usual way. The patient made a good recovery.

DR. W. E. CALDWELL.—Several years ago Dr. Cragin did a cesarean section at Sloane. At a subsequent delivery Dr. Bailey induced labor at Bellevue. That baby died. The second time the patient's abdomen was opened very much the same condition that Dr. Williams and Dr. Ryder described was found—membranes bulging through the uterine wall. We delivered the baby, repaired the old scar, and did a subsequent cesarean on this woman. The following year after that she had another cesarean and we sterilized her.

DR. E. T. HULL.—A few years ago I did a cesarean section which was of particular interest to me, because I saw the uterus when it ruptured through the old scar. The patient had had a cesarean section before that and had run some temperature postpartum. Upon opening the abdomen there was noted a blue line which looked like a distended vein extending along the site of the old incision, and that apparently was made up entirely of peritoneum. As I introduced my hand to see if there was a rupture of the uterus the upper part of the thinned-out membrane ruptured and the placenta prolapsed through the rupture. I enlarged the rupture through the thinned-out scar and delivered the patient. I then cut out the thinned-out edges and was able to get good approximation. I did not do a hysterectomy. The patient and baby made a good recovery.

DR. P. H. WILLIAMS (closing).—In reply to Dr. Ryder I would say that I took out the uterus because I was of the opinion that there was a fibroid there. In fact, she had a previous fibroid which had been removed, and I thought that possibly I was dealing with a fibroid uterus.

DR. HUGO EHRENFEST, of St. Louis, Mo., presented (by invitation) a paper entitled *The Normal and Pathologic Physiology of Pregnancy*. (For original article see page 58.)

### DISCUSSION

DR. W. W. HERRICK.—I have for a number of years, been very much interested in the medical study of certain phases of pregnancy at the Sloane Hos-

pital. It is interesting that our observations have led to much the same conclusions that Dr. Ehrenfest has expressed tonight in his paper, which shows a combination of broad clinical vision and meticulous scholarship.

It seems to me that during our own time we have seen three different phases of development of medical problems in process. The first phase, the study of disease as related to anatomic-pathologic changes in organs; the second, the relation of disease to disturbance in function. Those two phases of study tend to lead us to the belief that a given disease is associated with one organ or one group of organs. The third phase of study is one which we are just entering, that in which we are led to believe that many diseases are not related to structural or even functional disturbances of isolated organs or groups of organs, but are in their inherent nature a disturbance of general organic equilibrium, of correlation between organs in which hormone effects and the nervous system have important parts. In accordance with this hypothesis certain diseases are disturbances of general equilibrium and not necessarily a functional or structural disarray of a single organ or group of organs. It seems to me that certain disturbances of pregnancy illustrate this in a superlative degree.

Particularly have I been interested in the study of the toxemias of pregnancy, not only because of their inherent importance, but also because they suggest the direction in which the solution of certain important medical problems may be carried out. It seems to me that the toxemias of pregnancy are not unit conditions; that we shall never solve that problem by seeking for an isolated toxin or for a disturbance in any given organ or group of related organs, but that we must solve the problem along broader lines. During the last six years' study with the help of Dr. Jean Corwin along the lines of a medical survey of each of the cases of toxemia, it has been impressed upon us that the majority of these women who show toxemia of pregnancy have some underlying disease. This underlying disease is most often manifested in the gastrointestinal tract, the endocrine system, or predominantly, in the cardiovascular-renal system. What is the proof of this? The proof of the relation of the pathology in these cases to the gastrointestinal tract rests largely upon clinical grounds. We know that women with faulty habits of eating, faulty bowel function, such definite pathology as intestinal adhesions and bands, very often have a functional upset during pregnancy.

The endocrine system is certainly disturbed in many of these women who show toxemia. From the first we were impressed with the frequency of the so-called pituitary type of woman in our toxic wards; the woman who was overweight, who had rather coarse skin, who had virilism in hair distribution, often with spaced incisor teeth, with heavy muscles and large hands and feet. Dr. Draper was asked to make anthropometric measurements of a large number of these women. He measured 117 of them and found that they corresponded in measurements with the so-called pituitary type, the type which is most prone to cardiovascular disease, characterized by arterial hypertension. Can it be possible that the pituitary gland is astray in these patients and that this is a fundamental fault in the etiology of hypertensive cardiovascular disease, as of toxemia of pregnancy?

As to cardiovascular-renal disease, we have found that a very large majority of these women, studied at the time of their toxemia in the antenatal and postnatal clinics (some cases we have observed for over six years), show changes in the cardiovascular-renal system in the way of arterial hypertension, of that instability of the cardiovascular system which precedes established hypertension, in sclerotic changes in the retinal vessels or in the larger peripheral vessels, in cardiac hypertrophy or in persistent albuminuria. I think I am not exaggerating when I say that at least 75 per cent of the women in the toxic wards, or of the



women who have been through those wards, show changes in the cardiovascular-renal system. I believe that the relation between hypertensive cardiovascular disease and many of the toxemias of pregnancy is a fundamental one, and that the etiology of this most important and common disease that we call hypertensive cardiovascular disease, can be found related to the development of the toxemia of pregnancy. I believe that, if the toxemia of pregnancy is a failure of adaptation of the woman to the strain of pregnancy, hypertensive cardiovascular disease is also a failure of adaptation. Perhaps these two conditions are on related and similar grounds. I believe that the solution of the problem of hypertensive cardiovascular disease may be found in a study of these toxemias of pregnancy.

We are about to publish the results of our study of these cases at the Sloane Hospital. At the present time I cannot give you detailed statistics, but our present impressions are in agreement with the views of Dr. Ehrenfest that the toxemias of pregnancy arise from a failure of adaptation. We believe that toxemia occurs, rather because the woman is a deficient being and has some fundamental pathology, than because she is pregnant. I believe that the solution of many medical problems lies along this line and that a careful study of the reactions of a woman during pregnancy will give a very accurate prognosis as to her future reactions to the strain of life itself. With this point of view I judge Dr. Ehrenfest to be in accord. I think as a revealer of the pathologic trend of a woman the study of the reaction to pregnancy is of the utmost importance to the medical man.

DR. R. T. FRANK.—The enormous amount of material that Dr. Ehrenfest presented to us in his striking and masterly review of this subject is almost bewildering. At the same time to the attentive listener there was a distinct and very evident chain which started at the beginning and carried through to the end.

The first thing was his emphasis on the general aspect of the patient, the habitus. That, of course, is laid down, you might say, at the time of the mother's impregnation, the parents that were selected, life during childhood, development during puberty. These are the first things that must be considered and which will have a striking effect upon her ability to be a successful mother.

The second thing is the emphasis laid upon the premenstrual phase of the woman, i.e., before impregnation has taken place. Each growing follicle has a definite effect upon the entire maternal organism and especially upon the genital tract and the mammary system. When ovulation takes place, the corpus luteum continues the process. In the human female the evidence accumulating shows that ovulation probably takes place in the middle of what, from the uterine indications, we consider the premenstrual phase, and that after ovulation takes place the corpus luteum continues this hyperplasia of the entire genital tract in order to prepare for the ovum.

We now, as the term I am going to mention indicates, have evidence which enables us to see in what an impregnation without a fetus really consists. For instance, in the bitch, if impregnation does not take place, for fully forty days a process of pseudopregnancy occurs. The bitch would be an excellent subject in which to study the hypophyseal and other endocrine changes which may occur without the fetus and, therefore, it lends itself well to analysis. If impregnation takes place, in the first place the corpus luteum contributes to the hyperplasia, and as soon as the mass of chorionic tissue is sufficient, the placenta continues the endocrine process, and brings it to a successful conclusion at the time of labor. Gustavson and myself have tried to emphasize this frequently forgotten fact by coining the term *gestational hormone*, meaning thereby the secretion of follicle, corpus luteum, and placenta.

Then quite distinctly we have to deal with the fetal requirements and the reaction, which Dr. Ehrenfest also emphasized, of the fetus upon the mother. Now this reaction apparently, if analyzed, will be found to involve the genital sphere, producing the stimulation of the corpus luteum. I think that the continuation of the corpus luteum is undoubtedly due to the presence of fetal products, whether ferments or hormones. In other words, Dr. Ehrenfest has given us a very excellent generalization, and the only thing, small in itself, with which I could take any issue is the importance which he ascribes to placental ferments. I think they are as yet entirely unproved, except as any organ may contain ferments. That they have any general effect upon the maternal organization is, I think, inconclusively shown.

DR. HAROLD BAILEY.—I have been interested in this subject for twenty years, because it so happens that a case of mine in 1906 was the first in which the urine chemistry was studied throughout the pregnancy. The patient had pernicious vomiting in the early part of pregnancy and eclampsia at the end. I became a firm believer in the theory that one group of organs was responsible, and I retained this belief until 1913, when my attention was directed more particularly toward the liver. Since Dr. Titus showed us, in 1920, that the liver picture could be largely wiped out by sugar injections, I have felt that we must search further for the origin of this condition.

I think that the fetal protein is the actual cause of the disturbance, and I cannot but feel that further study along this line is logical, because we find emboli of syncytium in all parts of the mother. Furthermore, we know that under certain treatment the mother's condition clears up and the pregnancy goes on, even after eclampsia. So it seems that the fundamental fault can hardly be in the endocrine system, or in the relations between organs, for such conditions would hardly clear up so readily.

DR. EHRENFEST (closing).—I am far from claiming originality for these ideas. They represent the sum total of impressions I have gained from watching the trend of thought in obstetric literature for many years. Dr. Herrick very clearly pointed out how, in general medicine, failure, first with merely pathologic investigations, and later with chemical research, has finally lead to the present attitude of looking at the sick patient as an individual reacting in his own peculiar way to a disease that has attacked him. In a similar manner also the obstetrician should look upon the physiologic or pathophysiologic phenomena of a pregnant woman and her specific reactions to pregnancy. It is the main purpose of my paper to demonstrate that these reactions in general are those observed as well in the premenstrual stage. The general biologic effect of a certain phase of cyclic ovarian function continues and is modified if pregnancy follows the rupture of the graafian follicle. This thought of a continuity of ovarian hormone effect has been well brought out by the remarks of Dr. Frank. He and his coworkers have convincingly proved that follicular, corpus luteum, and placental hormones represent a practically continuous chain of potent substances which determine woman's sexual development and life from puberty to menopause. In my belief, these generative or gestational hormones determine to a great extent whether or not the pregnant woman will adapt herself promptly or completely to the various demands made upon her by pregnancy, granted of course, that she is a constitutionally normal and healthy individual. If she has deficient organs, full adjustment may become impossible. The demands of pregnancy may cause further deterioration in already damaged organs or may reawaken old processes. I thoroughly agree with Dr. Herrick that the seeming direct causation of a disease by pregnancy as

a matter of fact most frequently represents only the exacerbation of a preexisting condition, as I have mentioned, e.g., in speaking of pyelitis.

Dr. Bailey might find in reexamination of the patient he mentioned, that she is now suffering from a true nephritis. By insisting that some toxic substance passes from fetus to mother, he does not contradict my views as markedly as he thinks. I also admit that various substances pass from fetus to mother, but I maintain that they are not *per se* toxic, but become toxic only when the mother for some reason is not able to take care of them properly. The mother in this case is not able to adjust herself adequately to certain demands, though the demand itself is only physiologic. And I may emphasize once more, failure upon the part of the mother to adapt herself promptly or completely to the demands of pregnancy does not necessarily result in the accumulation of toxic substances in her blood, though all too readily the clinical picture is termed a toxemia.

DR. I. C. RUBIN presented a paper entitled **Sterility Associated with Habitual Amenorrhea Relieved by Roentgen Therapy.** (For original article see page 76.)

#### DISCUSSION

DR. J. A. CORSCADEN.—My experience with curing sterility by x-ray has been limited to two cases, without amenorrhea, and I think that probably makes a great difference. They were both without result. They were undertaken merely in the excitement of reading of the work when it was first done. We did not persist in it, because we were very much more occupied in attempting to produce the opposite effect, namely, sterilization in women with uterine hemorrhage and myomata. We were further inhibited by these same questions which Dr. Rubin raised as to the fundamental causes of the sterility, the knowledge that pituitary disease very often plays a rôle in sterility, the knowledge that thyroid therapy often cures the condition, etc., further, that amenorrhea was not entirely a measure, or at least an indicator, of sterility. In that connection I might cite a case that we found recently in the clinic, of a woman who has never menstruated, but who has had five normal children and four miscarriages, whose mother had the same history (I forget how many children she had), whose sister menstruates regularly and has never been pregnant—rather a peculiar combination of circumstances.

Secondly, we were held back by a wholesome respect for the x-ray, with its dangers seen and unseen. After one has worked with it personally one always hesitates to apply it without a very compelling reason. I must say, however, that our real reason has been that we were occupied with its other usages. The fear of attempting a new thing because it might do some harm, I think, is not always entirely worthy. If our ancestors hadn't taken some chances, I suppose we would still be hanging to the trees by our tails.

The danger to the fetus is, so far, based upon experimental evidence. There is some evidence that the lower orders are more susceptible to these germ plasm changes than the higher orders; that is, we call ourselves higher. For that reason I think that the presentation of such a fact, namely, that we have nine out of twelve cases apparently relieved, is reassuring. I do not know of any one who needs more help than one of these women who is told that her sex organs are normal, the so-called primary sterility, or nearly normal, and that the examiner can find no reason why she should not become pregnant. She will accept more or less the sterility following hysterectomy, or that due to tumor, inflammation, or some obvious thing, but the state of mind of the woman who thinks she has perfectly normal

organs and is kept sterile by some unknown force is most distressing, and I congratulate Dr. Rubin upon his results.

DR. HARVEY B. MATTHEWS.—These results bear out what we have believed from a recent comparative study made of rabbits and of human ovaries after irradiation. From this study, I have persistently maintained that a therapeutic dose of irradiation, be it x-ray or radium, would not be injurious to pregnancy, and, furthermore, that there was no reason to believe that the offspring would possess any anatomic abnormality.

Dr. Rubin spoke about the irradiation of the corpus luteum, saying that it was destroyed early. In our experiments upon the rabbit we found that the corpus luteum was the very last element to be destroyed following irradiation. The ripe follicles went first, the primordial follicles next, the germinal epithelium next; while the corpus luteum was the most resistant and, therefore, the last to be destroyed. This series of facts was borne out in the case of a woman that we studied, who had had a full carcinoma dose of 4,000 mg. hr. of radium, with hysterectomy four months later. We studied the ovaries. She had persistent corpora lutea with absolutely no other part of the ovary recognizable, no follicles of any kind and no germinal epithelium.

This study bears out the fact that there is no reason why a woman cannot become pregnant after a therapeutic dose of irradiation. Just how stimulation of the ovary takes place in these cases of amenorrhea and sterility, I am, of course, not prepared to say. There are evidently some changes within the follicle, and I would imagine that the primordial follicles that are not destroyed by the irradiation develop in a normal manner, and that there are perhaps, some inherent changes in the ovarian stroma, or in the germinal epithelium, or perhaps in the persistent corpora lutea, if there were any. These "runners-up," are in a healthier condition following therapeutic "doses" of irradiation. Otherwise, I do not offer any explanation.

Of course, irradiation after conception has taken place is an entirely different matter. We know from many case reports in the French, German, Russian and Scandinavian literature that there are anomalies of various organs, particularly of the central nervous system, due to radiation after impregnation has taken place.

DR. IRA I. KAPLAN.—The idea of stimulating the ovary is based upon the assumption that if we stimulate any biologic tissue in the body we create a response to this stimulation. As a response to any inflammatory reaction, the vascular supply, the flow of the blood cells, mostly the leucocytes, and, therefore, perhaps, the tension in the ovarian follicles is increased. This tension causes an explosion, as it were, or a rupture, which brings forth the new ovum which travels down and later becomes impregnated, or brings on menstruation, first, and then probably impregnation.

We must assume, then, that a certain dosage will cause this without stimulating the formation of fibroblasts, which create scar tissue formation or fibrous tissue, and, therefore, after much experimentation, it has been assumed that this dose is probably equivalent to approximately one-third the castration dose on the ovary. This is a little different than the third of the erythema dose, for if we give a dose of 100 per cent on the skin, according to the type of apparatus used, a certain amount of the dosage is absorbed by the tissue intervening between the surface of the skin and the ovary which you are attempting to radiate. Therefore, you must calculate the dosage so that the dose on the ovary is approximately 10 per cent. The variance is between 10 and 12 per cent in the usual run of cases. I have calculated that dose in my method of treatment. I give approxi-

mately 4 per cent from the front on the ovary and 6 per cent from the rear. The reason is that radiating through the abdominal wall there is much more absorption on account of the intervening layers of intestinal tissue, etc., and the dosage is lessened; from the back, while there is a great deal of absorption from the bony structures—and we give a larger dose from the back—an increased dose on the ovaries, due to the increased scattered radiation from the bony structures is obtained. This bony absorption is explained in the x-ray photographic plate; the bone structure absorbs a great deal of radiation and gives a shadow. Also, the bones give off a secondary radiation, and by actual ionization experiments it is found that the ray reaching the ovary in the back is of greater intensity than the one from the front; consequently about 6 per cent on the ovary from the posterior surface and 4 per cent from the anterior surface should be given. Thus there is 10 per cent on the ovary. Usually that is sufficient for bringing on menstruation. If it does not bring on the menstruation after a period of two to three weeks, the treatment is repeated in about four weeks from the time of the initial treatment. I never repeat after the second treatment, because then castration is certain.

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## BROOKLYN GYNECOLOGICAL SOCIETY

*MEETING OF FEBRUARY 5, 1926*

### **DR. RALPH M. BEACH reported Two Cases of Pregnancy Complicated by Fibroids.**

**CASE 1.**—Mrs. C., twenty-eight years old, a primigravida, married three months, was first seen by me Aug. 25, 1922. She had menstruated first at the age of fourteen, five to six week type, flowing six days, with comenstrual pain for half a day. Her last menstruation was May 8, 1922. General physical examination showed the heart, lungs, blood pressure, etc., to be normal. Abdominal examination revealed a median hypogastric tumor extending to the umbilicus. This mass was soft and felt like a pregnant uterus, though the amenorrhea was of only three and a half months' duration. There were no fetal heart movements. The culdesac contained a hard tumor mass, about the size of a tangerine.

**Diagnosis:** Subperitoneal fibroid complicating pregnancy. Gentle manipulation, in the knee-chest position, failed to dislodge the tumor, and the patient was advised to assume the knee-chest position twice daily, and report in three weeks.

This patient was seen at three week intervals; life was felt at four and a half months. At the fifth month she began to have rather severe backache and lower abdominal pains simulating labor. She was in the hospital for a week at this time and required morphine at intervals to control the pain. The tumor was still in the culdesac and could not be dislodged. There was no constipation. At six and a half months the above symptoms were repeated and the patient was again kept in the hospital for a week. From this time on the patient was more or less uncomfortable, requiring rest in bed and codeine at frequent intervals. By the end of the seventh month she was beginning to have steady pains in the left groin and in the middle of the back with some edema of the left leg. Vaginal examination revealed the tumor somewhat higher in the pelvis and toward the left posterior quadrant. The tumor itself did not seem to be very tender at any time and the symptoms seemed to be due rather to peritoneal irritation and nature's efforts to get the mass out of the pelvis.

All of the above symptoms continued until eight and a quarter months when they suddenly disappeared. Vaginal examination at this time revealed the culdesac free of any mass and the head dipping well into the brim.

The labor occurred three weeks later in the Israel Zion Hospital, the baby being delivered by low forceps, due to secondary uterine inertia.

This case gave us no trouble during the puerperium and at the end of six weeks the patient was symptom free. A small fibroid could be felt springing from the posterior uterine wall, apparently just above the internal os.

CASE 2.—Mrs. R., thirty-two years old, a primigravida, was first seen by me Oct. 7, 1925. Her mother and one of her two sisters had uterine fibroids. She had been married five years and had practiced contraception until recently. Menstruation began at sixteen, regular four-week type, moderate flow lasting three days, with slight pain at times. Her last menstruation was July 29. Abdominal examination revealed a large tumor mass in the hypogastrium extending 17 cm. above the pubes. It was slightly irregular in outline, hard, not tender and appeared to be a fibroid uterus. Vaginal examination showed anteriorly a softened portion of the uterus evidently that containing the embryo, and posteriorly, in the culdesac, a hard tumor mass about the size of a tangerine.

An attempt was made, in the knee-chest position, to displace this subperitoneal fibroid from the pelvis but without success.

The subjective symptoms were, backache, constipation, and hemorrhoids.

About four weeks later, the patient had an attack of severe pain referred mainly to the back, but also to the groins. These pains were more or less constant, did not resemble labor pains, and there was no bleeding. The pelvic fibroid was rather tender on vaginal examination, and the symptoms seemed to point to an effort on the part of nature to pull this mass out of the pelvis. With rest in bed and codeine, the symptoms disappeared in three days. The fundus uteri at this time was 22 cm. above the pubes, about the size of a seven months' pregnancy. Two weeks later, on Nov. 22, the patient again began to suffer from severe backache and pelvic pain, and did not respond to treatment. The entire abdominal mass was tender and the pelvic mass much more so than at any previous time.

The patient was sent to the Methodist Episcopal Hospital the next day for observation.

An enema was followed by severe pains in abdomen and back. Blood count: hemoglobin, 70 per cent; red cells, 4,000,000; white cells, 19,000 and polynuclears, 89 per cent. In view of the continuance of the symptoms, pain being relieved only by morphine, a laparotomy was decided upon.

Median hypogastric incision showed the lower portion of the uterus containing the embryo (about three and a half months' size), while the main portion of the uterus above was occupied by one large interstitial fibroid, extending to the diaphragm. There was also a pedunculated subperitoneal fibroid the size of a lemon springing from the right anterior uterine wall, twisted around the right broad ligament and incarcerated in the culdesac. This created a marked dextrotorsion of the entire uterus through 90°, the left adnexa lying almost in the midline. The pedunculated tumor was removed by ligation of the pedicle with the idea of preserving the uterus. Proximity of this tumor to the right broad ligament vessels caused uncontrollable bleeding. The size of the other tumor seemed to preclude the possibility of the patient going to term, and a supracervical hysterectomy, and bilateral salpingo-oophorectomy was performed, with peritonealization of the stump.

The postoperative course was uneventful.

## DISCUSSION

DR. A. C. BECK.—In our experience with pregnancy associated with fibroid of the uterus the conservative plan, such as was followed in these instances, has been pursued. Usually as the cervix dilates, the obstructing fibroid is pulled out of the pelvis and so out of the way for a spontaneous delivery. In regard to the case operated, I feel that the Doctor did the only logical operation permissible.

DR. A. M. JUDD.—One cannot determine the exact nature or extent of an operative procedure until the abdomen is open. At times these fibroids are found adherent to the rectum, and an extensive operation may be necessary to free them.

DR. C. A. GORDON.—I find it hard to make a general statement in regard to the treatment of fibroids complicating pregnancy. In general I would say that a fibroid in the lower uterine segment has a very good chance of being pulled out of the pelvis as labor progresses. I feel that each case must be watched and no definite course decided upon until the course of labor points the way.

DR. P. B. BLAND, of Philadelphia, read, by invitation, a paper entitled, **The Conservative Treatment of Uncomplicated Retrodisplacement of the Uterus.** (See page 89.)

## DISCUSSION

DR. F. C. HOLDEN.—In Bellevue Hospital there were 11,459 admissions to the Gynecologic Department with an operative incidence of 22 per cent. I am not in entire accord with Dr. Bland in respect to retrodisplacements. I like to think of them, first as congenital or acquired and second, to note the relation of the fundus to the cervix. To determine whether or not a retrodisplacement is causing symptoms I think it well to replace the uterus, if that can be done, and then hold it in place with a pessary. If the symptoms complained of are relieved by this procedure, it is fair to assume that the retrodisplacement was the cause of the symptoms complained of. Every case needs individualization.

DR. J. O. POLAK.—It is refreshing to note that posture, pessary, and tampon are at last recognized as definite measures of conserving the pelvis. There is no question that the uncomplicated congenital retroversion produces no symptoms, provided the woman does not get infected, does not get married or does not become pregnant. If any of these things come to pass we may find a definite train of symptoms, because of the definite tendency to circulatory stasis in the broad ligaments. I believe that Dr. Holden's point concerning acquired versus congenital retrodisplacement is well taken. The pity is that the younger men do not appreciate what can be done by patience and persistence in the use of the pessary, posture, and tampon in these cases. Retroversion, the result of infection, childbirth or interrupted coitus, causes a good deal of disturbance. I agree with Dr. Bland that the so-called antelexion is part of the symptom-complex, endocrine imbalance.

DR. H. M. MILLS.—I am glad for this note of conservatism as the present-day teaching tends to make the young doctor regard a retrodisplacement in the same light as he would an acute appendix; i.e., as an immediate cause for surgery. I agree with Dr. Polak that the cause of many of the symptoms produced by retrodisplacements is circulatory stasis.

DR. G. GIBSON.—Embryology will help to explain the uncomplicated retroversion, for in the fetus and even in early adolescence the uterus is high in the pelvis

and back in the pelvis, and it is only at puberty that it assumes the so-called normal position and at this time, in many women it does not come forward. After the menopause, in many women, the uterus assumes a retroverted position.

DR. C. A. GORDON.—I think the crux of the situation is the level of the cervix in the pelvic cavity. If that is approximately normal the retroversion needs no treatment. I disagree with Dr. Howard Kelly when he says that "the pessary is obsolete and almost of no value."

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## NEW ORLEANS GYNECOLOGICAL AND OBSTETRICAL SOCIETY

*MEETING OF FEBRUARY 18, 1926*

DR. PETER GRAFFAGNINO read a paper entitled **Air Insufflation of the Tubes.** (See page 98.)

### DISCUSSION

DR. A. H. GLADDEN JR.—You have warned us several times against using this method in cardiac patients; what indication would there ever be for subjecting such women to it? As a usual thing we are not desirous of having such patients become pregnant. Is auscultation not a satisfactory method of determining the patency of the tubes when attempting to insufflate them? Also how many have you opened up after this method had been used?

DR. JOHN F. DICKS.—Have you had any bad results after using this method, and particularly, could you trace any infections to it?

DR. P. T. TALBOT.—Is there any method by which the patulous or nonpatulous side can be identified? Have you had any complications, such as a resulting salpingitis or the spread of some already existing infection? Do you consider it possible that a sterile tube might be infected by air whose sterility has not been checked up? That is, do you consider air a possible infectious medium?

DR. P. W. CARTER.—I have never done air insufflation of the tubes myself, but I have read considerably on the subject and am very much interested in it. Certain points came to my mind as I heard Dr. Graffagnino's paper and I should like them cleared up. Has it been necessary to put any of the patients under anesthesia to dilate the cervix? More than once, in attempting to diagnose a suspected case of stenosis in my office, I have been unable to pass even a sound through the cervix, and I am wondering how, in such instances, it would be possible to pass a cannula, which is definitely larger. Like Dr. Talbot, I am interested in knowing whether it is possible to determine which side is patulous. I should also like to know whether you have any idea of the number of cases, previously sterile, who have conceived since insufflation was done. I refer particularly to those patients whose tubes were occluded at the time of the first insufflation, but in whom the agglutination cleared up after repeated treatments. If not, do you consider that agglutination has taken place again? I realize, of course, that in certain patients pregnancy never takes place, even though the husband has been eliminated as a factor and the wife's condition presents no obvious bar to conception, but I am interested to know whether in your series of cases any other factor might explain the continued sterility. In the patients subjected to laparotomy after this treatment have your operative findings coincided with the findings demonstrated by insufflation?



DR. L. A. LEDOUX.—Did the cases which continued sterile after the test have another check made on their condition?

DR. HENRY MACHECA.—In connection with the general subject of sterility I should like to add that in the last few months I have seen three patients become pregnant after resection of the tubes with burial of the ends in the broad ligament. One miscarried at four months, one went to term, and one is now three and one half months' pregnant. I have also seen several cases, about four, who were apparently sterile, conceive after an irritating condition about the cervix had been cleared up. Whether I am right in ascribing the conception to the clearing up of the condition I do not know, but it does appear to be cause and effect; the patients were definitely sterile, the cervical condition was treated, and conception followed. At any rate, it suggests that merely clearing out occluded tubes might not accomplish the desired result alone, and that chronic cervical infections should be cleared up in conjunction with insufflation of the tubes if we hope to secure the best results in this unsatisfactory and baffling condition.

DR. P. GRAFFAGNINO (closing).—Replying to Dr. Gladden's question about cardiac cases, I would emphasize that this method has, for the most part, a diagnostic value, and that frequently its purpose is to prove the existence of pelvic disease as well as to make conception possible. Cardiac patients, of course, are not exempt from pelvic infections, and it was against the employment of this diagnostic method in the presence of organic lesions that I wished to warn you. Auscultation is a possible method, but not a very satisfactory one. I might say that when we began this work we insufflated every preoperative case of chronic salpingitis and checked our operative findings against the insufflation findings as a routine measure. The results agreed so uniformly that we no longer do this as a routine. Replying to Dr. Dicks, we have had no bad results at all which could be attributed to the employment of this method. Replying to Dr. Talbot, the only way in which the offending and patulous sides can be identified is that suggested by Kennedy in 1922, so far as I know. He injected sodium bromide into the tubes under pressure, and then took a skiagraph immediately afterwards, thus showing the existence and location of the occlusion. As I said to Dr. Dicks, we could trace no bad results to this method, and certainly we had no resulting salpingitis or other type of infection. Two of the patients fainted, and one woman complained bitterly for a few days of pain and discomfort, especially when standing; in her case I am inclined to think we used too much air. I do not regard air as an infectious medium. As I have emphasized already, the strictest asepsis is observed throughout. The patient is prepared as carefully as if for delivery or operation, and every instrument is sterilized. Replying to Dr. Carter we have had no special difficulty in introducing the cannula. Occasionally a small Jolie dilator was used to open the cervix gradually, but anesthesia has never been necessary. We have encountered no instances of true stenosis. I am sorry to say that we have been unable in most instances to check up our findings, in order to establish the fact of continued patency of the tubes. We urge the patients to return to the clinic for repeated examination and treatment, but as practically all of this work has been done at Charity Hospital, you will understand the failure of our follow-up records. I cannot, of course, attempt to explain why those patients do not conceive whose pelvic condition is apparently normal, whose tubes have been rendered patulous, and where the husband has been eliminated. Such cases are on record everywhere, and they furnish one of the unsolved problems of our specialty. As I have already said, our operative findings confirmed our insufflation findings practically uniformly when we were investigating that phase of the subject.

**DR. P. T. TALBOT** presented a case of **Intracranial Injury in a Newborn Child.**

Mrs. B., white female, was admitted to Hotel Dieu in labor the morning of August 31, 1925, labor being terminated that afternoon about 4 o'clock. It was uneventful in every way, except for the administration of two small doses of pituitrin during the afternoon to stimulate rather sluggish pains. No instruments were used and no lacerations occurred. The puerperium was equally uneventful. The child was a male, weight 8 pounds, 4 oz., and was born markedly cyanosed. The heart was definitely beating, but respiration was established only after considerable difficulty by means of oxygen and the classical methods of artificial respiration. The child never cried satisfactorily, and in spite of every effort the respiration continued irregular, at times becoming quite stertorous, so that oxygen was given as indicated for several hours. The excretions were normal, and by the morning of the following day his condition seemed fairly good. That afternoon, however, muscular contractions began, being most marked in the right arm, the left leg, and the face, with the interval between them about fifteen minutes. Dr. Signorelli was at once asked to see the baby in consultation, and the future treatment was entirely under his direction. Iodides were given, together with horse serum, and an ice cap was applied to the head. Several hours later true convulsions developed, lasting from a few seconds to several minutes, and most manifest in the arms and legs, particularly the left arm. There was also considerable squinting of the eyelids. Respiration was improved, however, and the child nourished well. September 2 convulsions occurred at irregular intervals, the baby sleeping between the paroxysms; September 3 only occasional muscular twitchings were present, and on the following day these also ceased. September 5, because of a decided gastrointestinal disturbance which prevented nourishment by mouth, 50 c.c. of normal saline solution was administered by hypodermoclysis. September 6 the condition was worse, temperature 104, pulse rapid and weak. Stimulants were given throughout that day and night and were continued the following day. Hypodermoclysis was given as indicated for another week. At that time a slow but definite improvement began, which continued until September 20, three weeks after delivery, when the child was discharged. I have seen the child at intervals since, though he is, of course, under the care of a pediatrician, and in a general way I may say that I am far from satisfied with his condition. Dr. Signorelli believes that his progress has been good and that he will show no mental or physical effects from his stormy infancy, but I am not so optimistic. To me, the child has a rather blank expression, is decidedly not as observant as a baby of his age should be, and does not cry lustily.

I have presented this case, not because it is particularly unusual in itself, but to provoke some discussion of this important subject. I have read the literature rather widely, and I have been impressed, as I have done so, by several striking points. One of these is the relative frequency of the occurrence of spastic paralyses of various sorts, as well as the many mental abnormalities of later life which can be attributed to birth injuries, although many of them passed unnoticed at the time because there were no tangible manifestations to call attention to them. What steps are we to take to prevent such injuries, concerning the ultimate outcome of which we can only conjecture? They may pass unnoticed at birth, as I have said, and they may follow any sort of delivery. Are they unavoidable in most instances, or are they due to poor obstetrics? Again, when is operative interference indicated when the injury is immediately evident? In this particular case operation was considered, but the pediatrician felt that progress was satisfactory without it. I was rather interested, however, in another case delivered at the same time as this one, by forceps, which resulted in very obvious symptoms of intracranial

hemorrhage. Craniotomy was done; several blood clots removed, and the child made a perfect recovery. The location of the hemorrhage was the right temporal lobe. That baby, to my mind, is now perfectly normal in every respect, and I consider his condition far better than that of the child in the case I have reported.

This is, of course, an informal summary of certain points suggested to me by this particular case. The literature on the subject is voluminous and well worth an intensive review. I shall be interested to have the opinion of the Society on the procedure adopted in this instance.

DR. JOHN F. DICKS.—Within the last year and a half I have seen three cases of intracranial hemorrhage; one following normal labor, one following a midforceps delivery, and one, last week, following a face presentation. All of the children recovered. I believe there is undoubtedly in some cases a connection between intracranial hemorrhage and hemorrhagic disease of the newborn, and I believe also that Ehrenfest is right when he says that most intracranial hemorrhages of clinical importance are of the tentorial type. To my mind operative procedures are practically never justified because of the very high mortality, and because of the fact that spinal puncture is a simpler procedure and gives a higher percentage of cures. In all three of the cases I have mentioned the symptoms were the same. For the first seventy-two hours everything seemed normal, although afterwards it was recalled that in each case the babies had slept practically all the time. Then the breast was refused, they began to vomit, the temperature shot up to 103 or higher, convulsive tremors began, finally true convulsions. The treatment in all cases was the same; I might say that Dr. Delahoussaye handled one, Dr. Bloom the others. The convulsions were controlled by chloral, spinal puncture was done and repeated as indicated, and fluids were forced in every possible way. The children a year and a half and six months old are apparently normal in every respect, and the child born last week also seems normal, but as Dr. Talbot has emphasized, the ultimate fate of the child is what is most important in these cases, and as to that we can make no prognosis. In none of these cases was there any instance of hemorrhagic disease, and to my mind they are all illustrations of the true tentorial type of injury, in which craniotomy could do no good. An interesting consideration in this important subject is that we cannot foretell when such injuries will occur, as every type of labor seems at some time or other to result in them. One of my cases, as I have said, was a labor that was normal in every respect, and yet brain injury followed. On the other hand, I recently saw three physicians deliver a case with forceps, and that child was born without evidence of hemorrhage. The midforceps case to which I have referred presented only moderate difficulty, and the child was born without evidence of scarring or pressure. The face presentation is the most interesting case. When I first examined the mother she was 3 fingers dilated, and was having relatively mild pains. Suddenly, just after the examination, terrific pains began, and when I examined her again, not more than five minutes later, the face had come down on the perineum and was perfectly black. I did an immediate episiotomy and lifted the head gently over the perineum with forceps, the child breathed readily, and after some little effort began to cry. After seventy-two hours the symptoms I have outlined began, the temperature went to 106, and death was apparently imminent. By heroic measures, however, the trouble was checked, at least temporarily, and at present the child is apparently normal. Blood transfusion sometimes helps these babies, and in my second case this was done directly under the skin, the theory being that the coagulation time is improved by this procedure and the bleeding checked. Horse serum is sometimes efficacious for the same reason. In all these cases the coagulation time was within normal limits, and there was no external and visible evidence of trauma.

DR. P. W. CARTER.—A recent issue of the *Journal of the American Medical Association* contained a very interesting article detailing the results of spinal puncture on some 300 newborn children, the series including both those with and those without symptoms. In each instance the puncture was done within twelve hours after delivery. The findings in a very large percentage—I do not recall the exact figures—varied all the way from a mere yellowish discoloration of the fluid to bright red blood. Two babies, as I recall, died as a result of the original injuries. All the hemorrhagic diseases of the newborn, whether of the essential type or due to some brain injury, are akin, and frequently, as you know, it is not possible to differentiate them. Was a spinal puncture done in Dr. Talbot's case? And what was the coagulation time? I think the general opinion today is that spinal puncture gives considerably better results than operative measures; it may be repeated as often as indicated, that is, until the discoloration of the fluid disappears and convulsions cease. In this connection I should like to report a rather interesting case of hemophilia under my care a few months ago. I first saw the mother when she was six months pregnant, at which time her coagulation time was thirteen and one half minutes. By treatment it was reduced to three and one half and her delivery was without incident. The child's blood was examined at birth, the coagulation time being three minutes. That afternoon, when I examined him again, I found blood issuing from the cord; this was definitely not due to the tie. The cord was tied twice, as is my invariable custom, with separate ligatures, and this hemorrhage, which was of a very mild character, was issuing between the tie and the abdomen. The condition rapidly cleared up, but I refused to circumcise the child, in spite of the continued low coagulation time, because of this very definite diapedesis. Another somewhat similar instance might be mentioned also. The mother's first pregnancy terminated in an induced labor at eight months for eclampsia. Two years later she had an entirely normal, full-term pregnancy. Twenty-four hours after birth the child began to vomit blood, and also to pass blood by rectum. Three days of treatment by horse serum cleared up the condition and to date there has been no recurrence. The origin of these conditions is unknown, but there is certainly some underlying relationship between the hemophilias, the internal hemorrhages and the cerebral hemorrhages of the newborn. The most important point to be emphasized in such a discussion is the necessity of watching the children. Faint twitchings and slight tremors are too often disregarded until it is too late. A spinal puncture in any suspicious case does no harm, and may be the means of both diagnosing and clearing up a condition which, if untreated, will jeopardize the child's whole future. The good results of this treatment can easily be explained: by the reduction of the pressure, the exudate is either absorbed or drawn off before it clots, and further trouble is thus avoided.

DR. L. A. LEDOUX.—In spite of the immense literature on the subject of hemorrhage in the newborn, it is evident that as yet we have only scratched the surface of this immense field. Several points are suggested by this particular case. I am wondering, for one thing, whether the two doses of pituitrin, no matter how small, might not have been responsible for the injury. The labor was normal in every respect, the duration was average, and no instruments were used, and, unless the pituitrin was responsible for an increased overlapping of the cranial bones, there is no explanation for the injury which occurred. In my service we have been doing spinal punctures for the last three years in every case in which we suspected brain injury, both for the diagnostic and the therapeutic effect. Difficulty in establishing normal respiration after delivery should make us suspicious of these injuries, and vomiting or inability and lack of desire to nourish is another important diagnostic point. In every single instance in which we did a spinal puncture and removed blood stained fluid, whether under pressure or not, there was a definite improvement. If Dr. Talbot, in comparing a case handled by operative meas-

ures with his own, is referring to the same case I have in mind, I might say that in that instance craniotomy was done five days after delivery, when the child was practically moribund, and for my own part I consider the fortunate outcome a mere piece of good luck. Craniotomy in cerebral hemorrhage in the newborn has such an appalling mortality that few of us would care to advocate its routine performance. I think I may safely say that the physician who handled this particular case has learned since that spinal puncture is good obstetrics and good pediatrics, and that he is likely to handle future cases by the simpler method. The solution of the whole problem, as Dr. Carter has emphasized, lies in more careful watching of the newborn babies, so that slight symptoms shall not be disregarded.

DR. P. GRAFFAGNINO.—Spinal puncture has a definite therapeutic value in intracranial hemorrhage. Of late we have used spinal analgesia frequently in our operative work, and careful checking has shown a considerable drop in blood pressure within fifteen or twenty minutes after puncture was done. I recall at least one instance in which a systolic pressure of nearly 300 dropped to around 70 in a short time with no apparent effect on pulse or respiration. Repeated puncture in hemorrhage of the newborn, by reducing the blood pressure, enables coagulation to take place sooner, and this seems to me one of the principal reasons for advocating its routine performance in such cases.

## NEW YORK ACADEMY OF MEDICINE, SECTION ON OBSTETRICS AND GYNECOLOGY

STATED MEETING, HELD NOVEMBER 24, 1925

DR. EDWIN W. HOLLADAY IN THE CHAIR

### DR. RALPH A. HURD reported two cases of **Ovarian Cysts Removed During Pregnancy Without Its Interruption.**

CASE 1. Age twenty, pregnant for the second time, came into the outpatient department of the Woman's Hospital during her sixteenth week complaining of sharp abdominal pain and general prostration. A mass the size of a large grapefruit and slightly tender was found occupying the umbilical region, while pelvic examination confirmed the presence of a normal intrauterine pregnancy. The mass was very freely movable and could be pushed upwards and outwards into either hypochondriac region. Dr. Dougal Bissell performed an abdominal section two days later. The mass proved to be a pedunculated dermoid of the left ovary which had become twisted at its pedicle almost to the point of strangulation. The entire appendage on that side, together with the tumor, was removed and the right normal ovary allowed to remain *in situ*. In this case it is assumed that the lutein cells were present in the removed diseased ovary as the corpus luteum of pregnancy could scarcely have been overlooked in the small normal ovary at sixteen weeks, when it would occupy a third or more of the total size of the organ.

Here, then, is a case of pregnancy uninterrupted after total removal of one ovary containing a large dermoid and, in all probability, a true corpus luteum body, this opinion being based on the absence of the latter in the normal ovary which remained.

CASE 2. A primigravida of twenty-three, who was first seen in the twelfth week. History negative except for a variable degree of dysmenorrhea, and she had never before had a pelvic examination. Her last menstruation was normal, had occurred on November 3rd. On January 20th she went to her physician for examination and

advice concerning her suspected pregnancy and was referred to me for obstetrical care.

Examination showed a somewhat soft uterus which gave the impression of an early pregnancy, but in addition to this there was a globular, elastic mass, quite insensitive, which filled the entire pelvis and extended upwards into the abdomen almost to the level of the umbilicus. A diagnosis of ovarian cyst was made.

On account of the possibility of complications arising later in pregnancy, laparotomy was performed. The right ovary was the seat of an irregularly spheroid cyst, somewhat constricted at its central portion, which had attained the size of the head of a newborn and which had so invaded and distorted the organ as to render the normal ovarian tissue no longer recognizable. A smaller tumor of similar type, the size of a hen's egg, was found arising from the left ovary, while both tubes appeared quite normal, and a pregnant uterus, corresponding in size to the duration of her amenorrhea, occupied the anterior part of the pelvic cavity. Oophorectomy, together with resection of the cyst, was performed on the right side and the smaller tumor excised from the left ovary, leaving a crescentic rim of normal tissue on one side as the patient's only remaining ovarian substance. In this, again, there was definitely no corpus luteum substance so far as careful inspection was able to demonstrate.

The pathologist reported from both sides the various elements which characterize dermoid cysts of the ovary, including formation of bone and teeth. The sections taken did not show lutein cells, although they are assumed to have been present somewhere in the tumor mass.

The patient made an uneventful operative recovery and continued with her pregnancy quite normally. She went into labor a few days before her expected date of confinement and was delivered of a normal male child, there being nothing unusual about her labor or puerperium, other than the fact that she had a breech presentation.

Six weeks after confinement she was obliged to stop nursing the baby because of a breast abscess, and shortly after that she had a normal menstruation, sufficient proof of the presence and function of the remaining ovarian tissue.

Bimanual examination now shows a normal anteposed uterus, which is freely movable, and no evidence of further pathology in either lateral fornix.

Here, then, is a case where a laparotomy was performed in the twelfth week of gestation with operative manipulation of both ovaries, each of which contained dermoid cysts. The tumors, the entire right ovary, including beyond doubt the true corpus luteum, and a major portion of the left ovary were removed without untoward effects on mother or child. It is interesting to speculate what would have happened had one step further been carried out and the patient been deprived of all ovarian tissues. The amount and kind of ovarian tissue removed during pregnancy and the consequent effect upon the continuation of this process appears to be an extremely variable quantity, as many patients have aborted after laparotomy where much less work was done.

The records of the Woman's Hospital, covering, roughly, the last fifteen thousand admissions, show only eight patients who were operated upon during pregnancy with the express purpose of removing ovarian tumors and allowing pregnancy to continue. Of the other six all were operated upon between the twelfth and sixteenth week, the tumors having been discovered during routine examination when the patients presented themselves for diagnosis of pregnancy. In five of the six cases the pathologists found lutein cells in the material examined, and four of these patients aborted while still in the hospital. The fifth patient of this group, a colored woman of twenty-five, was still pregnant two months after her operation, and it is assumed that she went on to term. The sixth patient had a simple multilocular cyst, in which the

presence of lutein tissue was not mentioned, and she went on to term and a normal delivery. Two others with unilateral involvement were followed by normal pregnancy and confinement, one (1) of these being a simple and the other (2) a corpus luteum cyst.

### DISCUSSION

DR. ROBERT T. FRANK.—In deciding on the clinical aspects of operating on ovarian tumors during pregnancy, three factors must be considered. In the first place, is the corpus luteum essential for the continuation of pregnancy, and if so, for how long a period is it essential? In the second place, is ovarian tissue, aside from the corpus luteum, essential, and if so, when? In the third place, we have to consider the mechanical tolerance of the uterus itself.

As far as the corpus luteum is concerned, we know that in different species it is essential for nidation for different periods of time. The earliest case in which nidation has proceeded after removal of the corpus luteum in which we have any really worth-while record is one between the fifth and sixth week of pregnancy. From then on I don't think that the removal of the corpus luteum plays any further rôle as far as nidation is concerned. I might add that, as a matter of fact, my work has convinced me that the placenta takes up the necessary hormonal secretion which is required to keep up the hyperplasia of the uterus in order that it may grow and form a proper container for the uterus.

As far as the mechanical tolerance of the uterus is concerned, I think the optimum time is between the fourth and seventh month. If during operation care be taken not to expose the uterus to the cold, to tie the pedicle as far away from the uterus as possible, to have as little intraperitoneal manipulation as is consistent with technical safety. I recall a case where I had to operate on a myoma which had become necrotic, in which I actually saw the fetus through the membranes. Unfortunately, I tore through the mucosa. I sewed it up carefully. That was about at four and a half months, and I later delivered the baby. That is about the most radical intervention that I know the uterus tolerates. On the other hand, I recall another woman who at the age of 21 had one ovary removed and then some two years later conceived, and at the fifth month a large abdominal tumor was found. The diagnosis lay between large hydroureter and ovarian cyst. We decided on ovarian cyst and I removed the ovarian cyst and the pregnancy came to term, which would be another case for Dr. Hurd to add to his statistics where the pregnancy came to term, in spite of the fact that no ovarian tissue existed. She never menstruated again, so that was pretty good proof that no ovarian tissue was left.

DR. E. H. DENNEN.—I have observed three cases of this nature, all in primiparae, one at six months, one at four and one-half months and the other at six to eight weeks. Two of them have since been delivered, one by low forceps, and the other normally. The third case, at six to eight weeks, is still in the prenatal clinic at the Nursery and Child's Hospital. One of the three cysts contained, according to the pathologist, a corpus luteum of pregnancy.

DR. EDWIN W. HOLLADAY.—Within the past few weeks I had a patient a little over three months' pregnant, whom I operated upon and the pathologist reported a corpus luteum cyst. The other ovary was carefully examined and there was no evidence whatever of any corpus luteum. She was well morphinized and given hypodermic of luetin for the first few days and then by mouth. She went on to term without any trouble whatever.

DR. LOUIS J. LADIN.—It has been my custom to operate for ovarian cyst, if it was sufficiently large to be palpated, in the early weeks or months of pregnancy. It

may be that I happened to have fortunate cases. This year I have had three. In one an ovary containing the corpus luteum was removed and the woman was recently delivered. In another, subsequently delivered, there was a small dermoid cyst and a bad ovary containing a corpus luteum. Neither of these patients received luetin and it is not my practice to give it.

DR. MEYER R. ROBINSON read a paper entitled **An Orientation of the Biomechanism, Pathology and Clinical Phenomena of Extrauterine Pregnancy, Based on a Study of 131 Cases.** (For original article see page 1.)

#### DISCUSSION

DR. ALFRED PLAUT.—I would like to ask in what percentage of these cases the decidual reaction was timed. Without having data at hand, in the cases which I have had the opportunity of studying, I found between 5 and 10 per cent. This depends absolutely upon the frequency of the decidual reaction and leads to another point where disagreement of opinion must exist between different observers. I would never call this formation which partly or completely separates the sac from the tube lumen a reflexa because I consider the mechanism in the uterine nidation is a tubal nidation fundamentally different. In the uterine nidation the ovum is imbedded wholly in the so-called compact layer, giving a real, nearly compact layer of stroma cells and later on decidual cells which are situated between the surface of the epithelium and the areola of the glandular ducts. Such areola do not exist in the tube. A thick decidua giving a real bed for the ovum is very seldom, if ever, formed in the tube, so the ovum digs its bed in the other layers of the tube and so-called external rupture frequently follows. Secondly, in the uterus we have one lumen not interrupted by a solid structure. It lies behind the ovum when the latter has imbedded itself in the compact layer of the endometrium in the tube. On the other hand, there are the mucosal folds, the so-called villi, behind the ovum. A more or less inflammatory state is present in many, if not in all cases of tubal gestation; so the tubal folds may coalesce in a kind of membrane with a decidual reaction, and in some cases this results in a more or less complete separation of the ovum from the rest of the lumen. There is some resemblance between this layer and the reflexa, but, morphologically speaking, these two layers are different, and while it may be a matter of opinion, I, personally, would not call this layer a reflexa, putting it on equal footing with the reflexa in normal uterine pregnancy.

DR. EMILY D. BARRINGER.—I would like to ask what part gonorrhea plays in ectopic gestation.

In a series of 1300 cases of gonorrhea, diagnosed serologically and bacteriologically, we have not had one case of ectopic, and in the same series we had 71 cases of intrauterine pregnancy.

DR. LOUIS J. LADIN.—I am very glad that there are a few who still believe that the death of the ovum is not the cause of bleeding. Here is another instance where the clinical experience does not coincide with the laboratory experience. After watching and observing nearly 400 cases from the clinical standpoint, especially many years ago, when the main object in meeting a case of tubal pregnancy was to make the diagnosis, a great deal of study was given to the clinical features of the case. I do not hesitate to say that the absence of uterine bleeding in a case clinically, to me pointed to a termination of the pregnancy, and I do not care what the laboratory reason is for the same. Within recent years I have had occasion to prove that as soon as the uterine bleeding ceases there is no question that on opera-



tion; you will find a terminated pregnancy or an ovum that has been completely separated from its surroundings, whether it be in the tube or in the abdominal cavity.

As far as the question of tubal abortion is concerned, I agree with the reader of the paper that the term "tubal abortion" should not be applied to those instances where there is bleeding from either the fimbriated extremity or through a rupture, which I always have regarded as tubal abortion. With very few exceptions do tubal pregnancies go on to term; they abort.

DR. DAVID N. BARROWS.—I differ with the question of the usefulness of the tube after so-called tubal abortion. I treated a woman two years ago who was operated upon for tubal abortion and the tube left in. The other tube was removed a year or so later for ruptured tubal pregnancy and the woman subsequently had an intrauterine gestation, we believe, through the tube which was left in.

In a series of cases observed on the service at Bellevue, where we were watching for the "shoulder pain," it seemed to run somewhere between 33 and 40 per cent, and we did not consider it a very trustworthy sign.

Cullen's sign I have not observed as frequently, about four or five times in the last two years, and it seemed to have the color in those cases more of a hematoma or trauma, as for example, that of a "black eye," rather than the shimmer of blood through the skin.

DR. MEYER R. ROBINSON (closing).—I agree with Dr. Plaut that the histologic condition in the tube is different from that of the uterus. If they were similar the tubes would not rupture. I only laid stress on the fact that the moment the ovum is right for placentation, no matter whether it be in the uterine mucosa, the tubal mucosa, the follicular mucosa or the peritoneal surface, it does not remain on the surface, but digs its way into the submucous structures. In the uterus it needs a very hypertrophic, hyperplastic, highly vascularized layer, and that suffices for forming the future nest without invading the muscularis uteri, but when it gets into the tube and the tubal mucosa is not sufficient, it must encroach upon the tubal muscularis which only temporarily delays the final fatal termination, but does not prevent it.

As far as the lining of the tube and that of the uterus are concerned, they are microscopically different, but if we trace them back embryologically it is only a continuation of the same *anlage*. The uterus and the tube only later become differentiated. So whether Dr. Plaut wants to recognize the folding over of the tubal folds as being identical with the folding over of the mucous folds and call it a reflexa, is immaterial, but anatomically they are alike and they act similarly. Placental blood may escape; otherwise there would not be established an intercommunication between the maternal and the fetal structures. Physiologically they aim at the same thing and anatomically they don't differ very much. So we cannot help, at least in those cases where we find a reflexa, stating that it is a reflexa, even if it is an ectopic pregnancy.

The percentage of decidual reactions I cannot state, but my experience has been that the earlier in the course of pregnancy you examine ectopic pregnancy, the more likely you are to find a decidual reaction, and as the pregnancy grows older the finer structures of the decidual reaction are lost.

Dr. Barringer's information is very valuable, and bears out just what I stated in my paper, that it is not inflammation and it is not a purely mechanical condition, on which so much stress has been laid and repeated over and over again, which is the cause of tubal pregnancy. There is a far greater functional disturbance of the tube which is responsible in the vast majority of cases, in my experience, because real inflammatory conditions were not found frequently. Most of my cases showed no perisalpingitis, adhesions, torsions, twists or anything else; the tubes were per-

fectly normal. We had two only this afternoon and both had normal tubes—no gonorrhea or infection, and both women had borne children, one of whom had her last child about sixteen months ago and the other two years ago.

As to the question of leaving the tube: this also is included in my paper, but I did not read it. The question of leaving the tube behind was recently revived in Italy because one case is quoted where the tube was removed for a tubal pregnancy and the patient conceived again, resulting again in tubal pregnancy, and she had no children; therefore, these Italian operators became conservative, they incised the tube, removed the ectopic, closed the tube and let it alone. I agree with leaving the tube behind if you can guarantee as to which tubal pregnancy will terminate in a mole and which will go on to fatal bleeding. If I could tell these things beforehand, I would not operate on these cases.

Dr. Ladin's teaching regarding uterine bleeding is valuable, but I can only define my thesis by physiologic and pathologic facts as they have been given to us within the past ten years. If other reasons for bringing out the other viewpoints are stronger, I will be glad to change my viewpoint.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Selected Abstracts

### Diseases Complicating Pregnancy

Ivens: Five Specimens Illustrating Necrobiotic Changes in Fibroids Associated with Pregnancy. The Journal of Obstetrics and Gynaecology of the British Empire, 1922, xxix, 639.

Examination of five necrotic fibroids, three removed during pregnancy and two during the puerperium, revealed marked degeneration in both the muscle and connective tissue. In the early stages the muscle cells were swollen, shortened and showed pycnotic changes in the nuclei. The general appearance resembled coagulation necrosis rather than hyaline degeneration. When degeneration was advanced, the whole fibroid was practically a homogeneous mass destitute of nuclei. Edema was not noted. Thrombi were not seen in the vessels. The line of demarcation between the normal uterine muscle and the fibroid tissue was sharp. Extravasation of blood occurred but was never accompanied by deposits of blood pigment. Leucocytic infiltration was sometimes present. The degeneration present in these tumors is due either to thrombosis or to a toxin acting only on the neoplastic cells.

H. W. SHUTTER.

Rioux: Necrotic Fibromata and Pregnancy. The Journal de Médecine de Bordeaux, 1923, xcv, 156.

The author found in the literature 28 cases treated by operative procedure with three resulting deaths. Excepting in interstitial tumors, severe pain was a symptom in all cases and developed with the cause for necrosis (torsion, pressure etc.). Nausea, vomiting, rapid pulse, temperature, jaundice, intestinal obstruction, distention and tension of the abdominal wall are symptoms which vary in intensity with the peritoneal involvement. Urinary disturbances are frequent. Examination usually reveals a painful periuterine tumor which may be found to have increased markedly in size with the onset of symptoms. Diagnosis is frequently difficult, the condition being confused with pregnancy in an incarcerated retroverted uterus, torsion in the pedicle of an ovarian cyst, pregnancy in the uterine horn, or appendicitis. The diagnosis of a necrotic fibroid complicating pregnancy calls for immediate operation. The choice of operative procedure depends on the period of pregnancy, the location and size of the tumor, the presence of infection and the condition of the patient. Myomectomy, the operation of choice, is simple in cases with pedunculated fibroids, but more difficult in the interstitial tumors and in the tumors of the lower segment in advanced pregnancy. Infection contraindicates myomectomy. Where a hysterectomy is to be done it is preceded by cesarean section when the fetus is viable.

H. W. SHUTTER.

Fischmann, E. W.: Fibroids in the Puerperium. Surgery, Gynecology and Obstetrics, 1924, xxxix, 327.

The author reports an instance in which a definitely palpated interstitial fibroid was spontaneously separated from its uterine wall attachments in the puerperium and subsequently partially expelled. After a critical review of the literature and

a survey of his own statistics, he concludes: (1) Fibroid tumors in the puerperium may cause serious complications, frequently a febrile course. (2) Fibroid tumors themselves may suffer changes during gestation and labor, and these may progress and even be augmented by secondary infection during the puerperium. (3) When a woman with a fibromyomatous uterus becomes pregnant and goes to term, cesarean section with an immediate myomectomy or hysterectomy is the operation of choice. (4) When the myoma is not discovered until during labor or in the puerperium, conservatism should be practiced as long as possible. WM. C. HENSKE.

**De Gaudino, Maria Teresa F.: Ovarian Tumors Complicating Pregnancy, Labor, and the Puerperium.** *Semana médica*, Buenos Aires, 1921, xxviii, 389.

Ten instances of this complication are reported occurring in 13,313 deliveries. Two of these were at term, and were explored by the abdominal route. In both cases, it was impossible to expose the tumor sufficiently without drawing the uterus forward in such a way as to endanger the blood supply to the placental site; consequently a cesarean section was necessary in each case. In the third case the diagnosis of a cyst was made during labor and it was punctured through the vagina. Cases 4 and 5 were cysts removed by laparotomy during the fifth and six months. The sixth patient left the clinic before labor. Case 7 was that of a patient with a cyst which ruptured during labor; a laparotomy was done the second day postpartum and drainage established, but the patient died of peritonitis. The eighth case was operated on two months after delivery, the tumors having been mistaken for inflammatory masses. The ninth and tenth cases were of tumors removed during the puerperium, the former for a twisted pedicle, the latter for malignancy.

Ovarian tumors diagnosed during the first months of pregnancy should be removed. In the last months those tumors localized in the abdomen and not interfering with labor should be let alone until after the puerperium. Pelvic ovarian tumors which cause dystocia should be removed during labor, without cesarean section whenever possible. During the puerperium such patients should be treated according to the symptoms caused by the tumor. THOS. R. GOETHALS.

**Hermans: Acute Appendicitis during Pregnancy, Labor, and the Puerperium.** *Nederlandsch Tijdschrift voor Geneeskunde*, 1924, ii, 1004.

Hermans does not believe that pregnancy is a predisposing factor of any great consequence, but does not doubt that a latent or chronic appendicitis may be activated by pregnancy. He reviews the literature and his own cases and comes to the following conclusions:

Appendicitis may complicate pregnancy at any stage, even during delivery. As a rule, the diagnosis during pregnancy, labor, and the puerperium is not especially difficult, the main point being to bear in mind the possibility of its occurrence. Only by prompt operation can the prognosis be improved, the earlier the diagnosis and operation, the better for mother and child. He agrees with Cooke: "In case of doubt operation is safer than waiting."

R. E. WOBUS.

**Tédénat: Appendicitis Among Pregnant Women.** *Bulletin de la Société d'obstétrique et de Gynécologie*, 1925, xiv, 237.

In the French literature there is a marked paucity of information regarding appendicitis during pregnancy and the puerperium. In the Baudelocque Hospital in Paris, among 11,479 labors during a period of six years, there was only one case of appendicitis.

Since the prognosis is doubtful, all cases of acute appendicitis should be operated upon as soon as the diagnosis is made. During pregnancy the tender point is higher than McBurney's point and often there is an area of inflammatory edema near the costal margin and even in the flank in cases of retrocecal appendicitis. In three cases operated upon by the author, recovery was uneventful. The patients went to term and had spontaneous labors and normal puerperia. In a fourth case the operation was difficult because of a purulent retrocecal fistulous tract which had to be drained. There was much shock, and the patient aborted six days after the operation. In a fifth case operation revealed pus in the right side of the abdomen all the way up to the diaphragm. Metastatic arthritis of the knee occurred and the patient died of sepsis on the tenth day. J. P. GREENHILL.

Stork, F.: Pregnancy and Ileus. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxix, 12.

To the 128 cases of ileus occurring during pregnancy which had been reported in the literature, Stork adds five cases. Laparotomy was performed on all five patients, but one died. The latter had an invagination of the small intestine. In four of the cases an abdominal cesarean section was performed at the time of treating the ileus, while in the fifth case a vaginal cesarean section was done. In the four cases with abdominal cesarean, the baby was delivered before the ileus was corrected. In the future the author says the first step will be laparotomy and the decision to empty the uterus will depend upon the individual case. At the end of pregnancy and wherever there is a viable child, a cesarean section is indicated at the time of the laparotomy; for aside from the fact that the gravid uterus inhibits peristalsis, many fetuses die from toxins liberated during the period of intestinal obstruction and two-thirds to three-quarters of the fetuses that do not succumb, are expelled prematurely. Such uterine activity may be harmful to a patient recently operated upon. J. P. GREENHILL.

Moeller, W.: Mechanical Ileus during the Puerperium. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1922, lix, 273.

The author reports the case of a woman who suddenly developed acute abdominal symptoms during the puerperium. At operation a mechanical ileus was found which was due to a band extending from the flexura sigmoidalis to the right inguinal region.

Repeated pregnancies and labors greatly diminish the likelihood of mechanical ileus. Statistics of all cases of mechanical ileus occurring between the ages of fifteen and fifty, show almost twice as many in men, whereas the numbers were approximately the same in both sexes after fifty years of age. This is noteworthy as women have as many inflammatory conditions of the abdomen as men and have much more often gall bladder disturbances. They also have a great deal of genital pathology and numerous gynecologic operations, all of which tend to produce adhesions which may give rise to mechanical ileus. Of the 12 female patients who had ileus, no less than 7 had never been pregnant. Of the remainder there was an interval of from three to seventeen years between the last labor and the occurrence of the ileus. J. P. GREENHILL.

Schoeffer and Keller: Torsion of the Omentum during Pregnancy. *Bulletin de la Société d'obstétrique et de gynécologie de Paris*, 1923, xii, 441.

Torsion of the large omentum is very rare, only 134 cases having been reported up to 1913. From experimental work on animals as well as from clinical experience it has been shown that the chief factor in the production of this torsion is the for-

mation of a pedunculated mass of omental tissue, while in others it is the fixation of the free end of the omentum to the bottom of a hernial sac or to any point of the abdominal wall. The weight of the mass which tends to lengthen the pedicle more and more, plays a greater rôle than the increase in venous pressure in the pedicle and the unequal growth of the mass. The immediate causes of torsion are mechanical in nature, as for example, peristaltic movement or strong abdominal pressure.

The symptoms of torsion without a hernia are usually vague at the beginning, but later there are acute symptoms which tend to confuse the condition with appendicitis. The crisis itself begins abruptly in a healthy person in the form of an acute pain in the right iliac fossa. Peritoneal symptoms predominate. There is vomiting, no passage of feces or gas, abdominal distention and the peritoneal facies. Soon, however, the symptoms disappear and one can feel a tumor mass at the site of pain.

The author reports the case of a primipara who had an attack of pain in the fifth month of pregnancy. A diagnosis of appendicitis or subacute cholecystitis was made, but at operation a twisted omentum was found. The twisted mass was resected. No similar case has been reported in the literature. J. P. GREENHILL.

Merletti, D. C.: Spasmophilia and Pregnancy. *Annali di ostetricia e ginecologia*, 1925, xlvii, 247.

In this article various conditions which often occur in pregnancy are considered in their similarity to comparable manifestations of spasmophilia. While laryngospasm is rare in pregnancy, spasm of the pharynx and esophagus are not uncommon, especially in nervous hyperesthetic women in whom hyperexcitability can be determined by electrodiagnostic measures. Spastic mydriasis of the pupils is also frequent in nervous subjects; so also cardiac tetany, which gives rise to faintness and at times syncope, together with variations in the heart rate. Localized spasm of the antral portion of the stomach and of the pylorus has been found by radioscopy to coincide with the nausea of pregnancy, and to persist without antiperistalsis during the act of vomiting.

Eclamptic convulsions are considered by the author to be closely parallel to the infantile convulsions of spasmophilia. Alimentary factors are important in both conditions, and the season is also a factor, inasmuch as convulsions are more common in cold than in warm weather.

The author concludes that in certain women there exists a state of constitutional hyperexcitability of the nervous system, which may be measured by response to electric stimuli, and which induces a disposition to localized spastic conditions and to convulsions. This state he would call spasmophilia of pregnancy, and would attribute it to endocrine dysfunction with especial parathyroid insufficiency. The treatment includes administration of calcium, bromides, and parathyroid extract, and the use of the ultraviolet ray in addition to dietary and eliminative measures.

THOS. R. GOETHALS.

Lambrinudi: Maternal Birth Palsy. *British Journal of Surgery*, 1925, xii, 554.

While pressure symptoms, such as cramps and pain along the course of the sciatic nerve, are relatively common during the latter months of pregnancy, actual paralysis is rather a rare condition. Lambrinudi reports two cases which came under his observation. In the first case, a primipara thirty years old, was delivered by high forceps after fourteen hours of labor. When she came out of the anesthetic, she experienced numbness and weakness of the entire right lower limb. On getting up three weeks later, she noticed acute pain along the back of the thigh and outer part of the leg and foot. There was definite foot drop. Five months later, she still showed paralysis of the toe extensors, the tibialis anticus and the pernei, with some

weakness of the toe flexors. Under treatment recovery progressed slowly. In the second case, a woman had lost her first child during labor three years previously. While supposed to have a flat pelvis, she delivered spontaneously a seven and a half pound baby after seventeen hours' labor. During the second half of the labor, she noticed acute cramps in the right leg below the knee. She felt relief afterwards, but a feeling of weakness and numbness persisted. On getting up, she noticed a right foot drop. There was definite paresis of the muscles supplied by the right external popliteal nerve, with dullness of sensation over the same area. The loss of sensation returned after two weeks, but the paresis remained. The author also quotes a case reported by Patel, in which the paresis came on spontaneously when the patient was five and a half months pregnant.

Lambrinudi discusses the theories advanced, especially toxic neuritis and pressure on the sacral roots, but believes it is due rather to traction on the sacral cord caused by a rotation of the sacrum. For this reason he condemns the practice of flexing forcibly the woman's thigh on her abdomen during delivery. In support of his contention, he quotes Fleming who states that the condition is not rare in the cow, in which it occurs usually from six to twenty days before labor. In making post-mortem examinations in such animals the gluteal muscles were found to be infiltrated and some of its fibers ruptured. The sacral cord showed evidence of injury ranging from the finding of large amounts of free fluid in the spinal canal with congestion of the membranes to the finding of actual injury to the cord with the presence of blood clots.

R. E. WOBUS.

**Bourne:** Etiology and Prognosis of Puerperal Insanity. *Journal of Obstetrics and Gynaecology of the British Empire*, 1924, xxxi, 251.

In the majority of cases the author found sufficient cause for the production of insanity even in the absence of any tendency toward the disease. In only 9 out of 69 cases could no cause for the disease be found. Eighteen had records of previous mental trouble or a bad family history. Infections after delivery accounted for eighteen (27 per cent) of cases. Nine suffered from eclampsia and 8 had had difficult labors. Anxiety during pregnancy seems a factor in the disease as 36 per cent of the mothers were unmarried.

Four women developed symptoms during pregnancy, 6 during labor, 39 in the first week of the puerperium, and 18 in the second week. The usual onset of the condition was sleeplessness after which anxiety and incoherent speech were common symptoms. Most cases were maniacal by the third day, a few were depressed and stuporous. Thirteen patients died, 6 of sepsis, 2 of self-destruction, and 2 of cardiac failure. Of 36 patients surviving 78 per cent were discharged as recovered, 4 as improved. All cases associated with uterine infections recovered in from a few weeks to eighteen months. Where eclampsia was a factor recovery was rapid. The average recovery time for the series was six and one-half months. If insanity is associated with serious organic disease, such as sepsis or eclampsia, the prognosis is good and recurrence infrequent. In the presence of previous attacks or a bad family history the outlook is less favorable.

H. W. SHUTTER.

**Nevermann:** Narcolepsy during Pregnancy. *Deutsche medizinische Wochenschrift*, 1921, xlvii, 1164.

A case of this rather rare disease is recorded, occurring in a primipara, twenty-seven years of age. During the twenty-sixth week of pregnancy, the patient was unable to sleep for three days and nights. After this, she was constantly overcome by sleep during the day, although she slept quite well at night. She would go to sleep during a conversation, at her work, or while walking, and then would be awak-

ened by stepping from the sidewalk, by striking against a tree, etc. Examination by a neurologist revealed no neuropathy, nor was it possible to determine any other pathologic process. Treatment of various sorts was of no avail, however, the condition subsided spontaneously at about the thirty-second week of her gestation. Later she was delivered of a normal child.

R. E. WOBUS.

Silberstein: Raynaud's Disease and Pregnancy. *Zeitschrift für Geburtshilfe und Gynäkologie*, 1921, lxxxiv, 208.

The author sketches briefly the chief clinical features of the disease, including the three types of attack: local syncope, local asphyxia, and gangrene. The patients are usually young neurotic women with a certain ability of the vasomotor system and the attacks frequently follow exposure to cold or psychic trauma. Other etiologic factors are intoxication and infections. Pregnancy seems to increase the severity of the disease, though there are but few reported cases. The author reviews these briefly and reports in considerable detail his own case which occurred in a neurotic young primigravida of twenty-two years. An attack of influenza in the third month was followed by an acute glomerulonephritis and three distinct Raynaud attacks, the second resulting in gangrene of several finger and toe tips. One attack followed prolonged exposure of the hands to cold water, another a family quarrel. Improvement was distinct and rapid following the induction of premature labor, which was indicated by the advancing nephritis and the severe secondary anemia. The author believes that pregnancy may aggravate the disease. Abortion is indicated in cases where gangrene is feared and its possible results are not offset by the desire for a living child. Where gangrene has already occurred, the indication no longer exists, since recurrence of attacks of gangrene is exceedingly rare. Especially in the pregnant cases, ergot poisoning must be considered in the differential diagnosis.

MARGARET SCHULZE.

Hussey, P.: Mental Conditions and Pregnancy. *Revue Suisse de Médecine*, 1922, xxii, 473.

The frequency of psychoses of pregnancy is difficult to determine, figures varying widely from 0.2 to over 1 per cent. Of these about 15 per cent occur during pregnancy, the rest in the puerperium. Toxic conditions, infections, and idiopathic conditions all appear to have a part. These mental complexes have no definite type peculiar to pregnancy, but the melancholic and depressive types play by far the larger rôle. This last class is to be divided into two separate groups, the maniac depressive type with fairly clear-cut symptoms, and the other class a psychopathic syndrome in the particular individual. In this group we find that fear of death in labor or a dread of what may occur cause the depression, and even may force the patient to think of suicide. Schizophrenic, hysterical, apathetic, and catatonic conditions may occur. The majority of the conditions come during the period of lactation and in the early puerperium. All these conditions need careful observation and study. If the condition cannot be benefited by the proper therapy then abortion is the choice. Some cases in which paralyzes, catatonic conditions, suicidal attempts have been observed demand not only abortion but also sterilization, and of course this holds true where a definite neurologic disease is diagnosed with a grave prognosis.

A. C. WILLIAMSON.

Macleane: Notes on Three Cases of Chorea Gravidarum. *Journal of Obstetrics and Gynaecology of the British Empire*, 1922, xxix, 630.

From the frequent history of previous attacks of chorea and articular rheumatism, the associated endocarditis and the resemblance of the condition to Sydenham's chorea, one must continue to classify chorea gravidarum as an infection and not as



a toxemia of pregnancy. The onset of symptoms is usually in the first three months and it generally occurs only in primigravidae. The mild cases recover and only exceptionally bring about spontaneous abortion. Mild cases respond to isolation, diet (milk) and such drugs as arsenic, aspirin, bromides, and chloral. The severe types carry a mortality of 20 to 30 per cent. Drug treatment is ineffective in the latter. The patients are hard to nourish and grow progressively weaker. The mortality is formidable with or without the interruption of pregnancy, but statistics justify the induction of premature labor if done before the onset of exhaustion.

H. W. SHUTTER.

**Ahlbeck: Polyneuritis Gravidarum.** *Archiv fuer Gynaekologie*, 1922, cxvii, 41.

Ahlbeck reports seven cases of polyneuritis gravidarum of which 4 were in primiparae. All began during the first eight weeks of pregnancy with the pernicious form of vomiting; four became icteric. Psychoses set in with dullness, loss of interest, and loss of memory; one had severe headache; two suffered from hallucinations, and one had retinal hemorrhages. Therapeutic abortions were immediately done in all of the cases but the peripheral nerves were already involved in six. Numbness and muscular atrophy persisted for some months. Examination twelve to eighteen months later showed all to have recovered normal gaits, but six still suffered from impaired memories.

RALPH A. REIS.

**Elkin: Spontaneous Labor in a Case of Decentralized Uterus.** *Journal American Medical Association*, 1922, lxxiii, 27.

A woman of thirty-five years suffered from cervical Pott's disease with an almost complete transverse lesion at the seventh cervical segment. She became pregnant and, at term, went into spontaneous labor. She experienced slight pain during the second stage, but there were no abdominal contractions, the uterus emptying itself after a labor of two hours' duration. The position was occipitoposterior and the child, which appeared perfectly healthy in every way, weighed six pounds. The mother died on the ninth day postpartum from tuberculous pneumonia.

R. E. WOBUS.

**Nishizuka and Iijima: Relations between Acute Infectious Diseases and Pregnancy.** *Kinki Fujinkwa Gakkwai Zassi*, 1925, viii, No. 2, 7.

In 67 patients with typhoid fever, spontaneous abortion occurred mostly in the second and third week of the disease in 58.2 per cent, with a maternal mortality of 35.9 per cent, which was about twice as large as the mortality in the cases in which pregnancy progressed undisturbed by the intercurrent disease.

In 11 cases of paratyphus the percentage of spontaneous interruption of pregnancy was only 22.2 per cent, the maternal mortality also being decidedly lower than in typhoid.

In 54 cases of dysentery during pregnancy, spontaneous interruption, generally occurring in the second and third week of disease, amounted to 33.3 per cent with a maternal mortality of 44.4 per cent, which is even higher than in typhoid. In all of these three types of infections it was observed that as a rule the patients with high temperatures miscarried, while miscarriage only rarely occurred when the fever ranged low. These observations seem clearly to indicate that the artificial interruption of pregnancy as a therapeutic measure will only tend to increase the risks to the mother.

There were too few cases of cholera, scarlet fever, smallpox, influenza and diphtheria in this series to permit valuable deductions.

AUTHOR'S ABSTRACT.

**Unger, R.: Successful Treatment of Severe Progressive Paralysis during Pregnancy with Malarial Inoculations.** *Medizinische Klinik*, 1925, xxi, 1498.

The association of pregnancy and progressive paralysis is uncommon. At the Rudolph-Virchow Hospital two cases were seen within six months. Both patients were in dire distress on admission and both showed the bad effect of pregnancy on the paralysis. Unger reports in detail the case of a patient who was treated for paralysis during pregnancy by means of inoculation with the quotidian type of malaria. The patient's husband had previously been successfully treated for general paresis by means of malarial inoculations.

The patient who was admitted in a critical condition, had 22 febrile elevations as high as 102.2° F. during the course of the treatment. At term she had an almost painless labor and delivered spontaneously a living child which weighed 2640 grams. The child was normal in every respect. Its Wassermann test was negative in contradistinction to the mother who had a strongly positive Wassermann reaction, and its blood like that of the mother showed no malarial organisms. The puerperal period was uneventful and the patient left the hospital with her baby on the thirteenth day.

The case shows that an intensive malarial cure did not endanger the pregnancy. The high temperature and chills did not cause an abortion, although other febrile conditions often do cause the termination of pregnancy.

Two months after the malaria fever disappeared, which occurred spontaneously, there was begun a course of treatments with neosalvarsan. J. P. GREENHILL.

**Deromps: Malaria and Pregnancy.** *Bulletin de la Société d'obstétrique et de gynécologie*, 1924, xiii, 227.

Physicians fear to prescribe for pregnant women suffering from malaria the necessary dose of quinine. Even those who are convinced of the innocuousness of treating malaria in pregnant women intensively, do not dare to prescribe full doses because of the fear of being held responsible for an abortion or premature labor if these should occur during the course of treatment.

Clinical observations, however, leave no doubt of the absolute necessity of administering quinine intensively. Malaria in pregnant women is much more progressive than in nonpregnant; the disease kills fetuses, produces abortion and may be transmitted to the fetus. Quinine seems to affect the uterine musculature only during labor but does not stimulate contractions as long as the cervix is closed.

It is true that only about 18 per cent of women with malaria go to term and this is probably the reason why abortion and premature labor are often attributed to the administered quinine. In these cases, however, the interruption of pregnancy is rather due to the fact that quinine is employed in a dosage insufficient to prevent the abortion. Pregnancy is interrupted because of the febrile reaction, and also as a result of the death of the fetus. Pregnancy at times affects the malaria patient to such an extent that a marked anemia results which may be fatal. Some patients who had malaria long before they became pregnant and had no recurrence during pregnancy have a return a few hours after labor especially if the latter had been associated with trauma. Such cases might be confused with puerperal sepsis.

J. P. GREENHILL.

**Pulgy Roig, Pierre: A Case of Fetal Smallpox together with Maternal Smallpox.** *Gynécologie et Obstétrique*, 1922, vi, 176.

The author reports in some detail a case of fetal smallpox acquired from the mother leading to intrauterine death of the fetus. This occurred about the fifth month of gestation. The fetus was mummified and presented typical pustules of variola.

F. L. ADAIR.

Regan-Litvak-Regan: Intrauterine Transmission of Anthrax. *Journal American Medical Association*, 1923, lxxx, 1769.

These authors take up the literature dealing with experimental work and case reports and add a complete report of the fifth case on record. They were able to show conclusively that the anthrax bacillus was capable of passing through the human placenta. The mother died of anthrax during the fifth or sixth month of pregnancy. The fetus was removed by section and all smears made from its various organs and the placenta showed the anthrax bacillus. W. KERWIN.

Koerting: The Treatment of Influenza in Pregnant Women. *Therapeutische Halbmonatshefte*, 1921, xxxv, 655.

Statistics from the Prag clinic show a higher incidence of influenza among the female attendants than among the waiting pregnant women; the mortality, however, is far higher in the latter. This indicates that pregnancy does not predispose to influenza, but does exert an unfavorable influence upon its course and especially is this true in the latter months of pregnancy. This is explained partly by a diminished resistance of the pregnant woman to toxic influences, but more by mechanical factors, since in advanced pregnancy the respiratory excursion is diminished and increased work is thrown on the heart and the circulatory system.

The mild cases need little more than rest in bed, salicylates, and diaphoresis. The multiplicity of therapeutic agents recommended in the severe cases indicates that none are entirely satisfactory. In the severe cases with profuse serous exudate in which the patients literally drown in their own secretions, the author has had good results with the use of adrenalin.

Abortion in cases of influenza in early pregnancy is not indicated, since the mechanical factors do not come into play. Later, emptying the uterus might have a beneficial effect, yet this is overbalanced by the trauma incident to the labor. Many of these cases fall spontaneously into labor, and these should be spared during the second stage by delivery with forceps. Major operative procedures usually give bad results. Postmortem cesarean section should be done when indicated, but will usually fail to save the child. MARGARET SCHULZE.

Mosher: The Complication of Purpura with Gestation. *Surgery, Gynecology and Obstetrics*, 1923, xxxvi, 502.

Mosher was able to find only 39 cases of purpura complicating pregnancy in the literature, to which he adds a case of his own. The condition has been observed mostly in multiparae and manifests itself ordinarily in the latter months of pregnancy. It is usually of the hemorrhagic form and characterized by hemorrhages from the mucous membranes, petechiae and ecchymoses, nonretractile blood clot with normal coagulation time, and a tendency to metrorrhagia. The diminished number of blood platelets is the most constant finding and is supposed to be the direct cause of the condition. Frequently other pathologic complications of pregnancy such as toxemia and infection are present and may be the cause of the purpura, but rarely the purpura is the only pathologic state demonstrable. Abortion or premature delivery is the rule, and influences the outcome favorably.

The child may or may not be affected, yet only one-half of the fetuses survive. The mother usually dies at, or soon after, labor from hemorrhage, if she carries her child to term.

Blood transfusion is the only remedy of any value, but must be repeated frequently as the platelets which are thus introduced are soon destroyed.

R. E. WOBUS.

Insfran, Jose V.: Treatment of Hookworm Disease in Pregnant Women with Carbon Tetrachloride. *Journal of American Medical Association*, 1926, lxxxvi, 735.

Previous to the introduction of carbon tetrachloride as treatment for hookworm disease, pregnancy was considered as a contraindication for antihelminthic medication. The writer treated more than a hundred thousand of the population of Paraguay with a combination of carbon tetrachloride and oil of chenopodium. All pregnant women were treated with carbon tetrachloride alone in a dosage of 2.4 c.c. with a simultaneous purge of magnesium sulphate. Two hundred and nineteen pregnant women could be followed until after delivery; in this group five abortions occurred.

GROVER LIESE.

Bio, L.: Tobacco Intoxication in Pregnancy. *Annali di Ostetricia e Ginecologia*, 1925, xlvii, 266.

The effects of tobacco upon cigar workers have been variously interpreted, and reports of investigators have been conflicting.

To determine the effect of such absorption upon fertility and pregnancy the author made use of guinea pigs, subjecting them to measured doses of extracts of tobacco leaves mixed with their food. In the first series, animals were subjected to intoxication before and during mating, in a second series, pigs were so treated after conception. Each series is subdivided into two groups, one subjected to mild doses, the other severely intoxicated. Series I, Group I, became pregnant and remained so; Series II, Group I showed a normal course of pregnancy, and were delivered at term of normal fetuses which were fully developed and which lived. Series I, Group II remained sterile, while in Series II, Group II, pregnancy was with one exception interrupted, with all fetuses stillborn or nonviable.

The author does not believe that the lowered fertility of Series I, Group II, is due to alterations produced by tobacco on the generative organs, for the uterus and ovaries in all these cases showed no variation from normal. In both Group II, however, the animals showed marked cachexia and loss of weight, and to this the author attributes both sterility in Series I and the birth of dead or nonviable fetuses in Series II.

THOS. R. GOETHALS.

Favreaux: The Thyroid Function and Pregnancy. *Journal de Médecine de Bordeaux*, 1922, xciv, 87.

During pregnancy there is a reciprocal action between the elements of the endocrine system which unites them in maintaining equilibrium and providing a physical defense against the toxic products of conception. The thyroid exerts a definite influence on the development and functions of the reproductive system through its effect on ovulation, menstruation, gestation, and lactation. Pregnancy and lactation call forth an increased thyroid activity shown in the gland by hypertrophy and a numerical increase in follicular elements. In certain cases this hyperactivity becomes pathologic and may persist. At the onset of pregnancy a certain amount of parathyroid insufficiency is seen. Hypothyroidism, a compensatory hyperthyroidism and a persistent, absolute hyperthyroidism have followed successively in the same patient. Pregnancy may be diagnosed in some animals, for example the cat, by the thyroid hypertrophy.

Where absolute hypothyroidism or myxedema exists, sterility is the rule. Fecundity in the hypothyroid cases seem to vary in direct proportion to the amount of gland tissue still functioning. When pregnancy exists these women usually go to term with about the normal percentage of complications, albuminuria, etc. When the woman with a previous total thyroidectomy becomes pregnant, tetany, albuminuria and mental and trophic disturbances are the rule. Partial thyroidectomy fol-

lowed by partial loss of parathyroid function predisposes to tetany in pregnancy. Aggravation of the condition during pregnancy is the rule in milder myxedematous cases, however, regression usually follows normally after term. Mild hypothyroidism is frequently benefited and occasionally cured by the compensatory thyroid activity of pregnancy. Except in pronounced myxedema, gland therapy during pregnancy gives good results. Apathy, hypothermy, sterility and even death are some of the sequelae supposed to have followed pregnancy in the partially thyroidectomized patient.

Sterility is the rule in the pronounced cases of hyperthyroidism. Toxemias and other complications exclusive of those arising in the thyroid are present in about the normal percentage in these patients. Predisposition to hemorrhage and hypertension have been noted in pregnancy complicated by hyperthyroidism. The symptoms of Graves-Basedow's syndrome are variously influenced by pregnancy. Lactation usually has a quieting influence on these women and nursing is generally indicated. Occasionally the milk in hyperthyroid mothers affects the offspring, even producing exophthalmos and tremor. Tetany, achondroplasia and varied disturbances of the osseous system have been noted in the nursing infants of mothers suffering from hyperthyroidism.

H. W. SHUTTER.

**Knaus: Thyroid Function during Pregnancy.** *Archiv fuer Gynaekologie*, 1924, cxxiii, 26.

Knaus tested the thyroid function in 35 pregnant women in the last months of pregnancy by injecting 0.02 mg. of epinephrin intravenously and immediately following it by an injection of epinephrin subcutaneously. The results obtained and the data which he had gathered from previous investigations, together with the results obtained by other investigators, leads him to conclude that there is a hypofunction of the thyroid gland during pregnancy rather than a hyperfunction as has been previously taught. Four patients who died intrapartum showed, histologically, a hypofunctioning thyroid gland. He believes, therefore, that thyroid therapy is indicated in pregnancy edema and other allied conditions.

RALPH A. REIS.

**Jülich, W.: Basedow's Disease and Pregnancy.** *Medizinische Klinik*, 1925, xxi, 928.

According to Novak and Seitz, among 98 cases of Basedow's disease associated with pregnancy that were reported in the literature, 60 per cent became worse while 40 per cent were not adversely affected. Some patients in fact improved during pregnancy. Jülich reports two cases of his own. In the first case, the patient near term had such severe subjective and objective difficulties that pregnancy had to be interrupted to save the patient's life. The second patient previously had an operation performed because of Basedow's disease and had practically no symptoms for four years. However, during pregnancy the thyreotoxicosis was so marked that the pregnancy had to be ended. In both patients examination later showed that subjective symptoms and objective signs had considerably diminished.

The author is of the opinion that a patient with Basedow's disease should avoid conception.

J. P. GREENHILL.

**Vignes, H.: Parathyroid Glands and Pregnancy.** *Journal de Médecine de Paris*, 1925, xlv, 7.

Vignes finds that during pregnancy there occurs a certain amount of parathyroid hypertrophy, due to a cellular multiplication. During pregnancy the calcium metabolism of the body is, to a large extent, controlled by these glands. Though the exact mode of action is not known, a parathyroid insufficiency is associated with a decalcification of the bones.

fication of the blood and tissues, which in turn lowers the sugar tolerance causing an abnormal excitability of the nervous system and tetany.

Intravenous injections of calcium lactate may relieve the symptoms temporarily, but permanent cure can be reached only by following successful parathyroid transplantation.

Vignes concludes that little is as yet known concerning the relation between the parathyroid gland and pregnancy.

THEODORE W. ADAMS.

Metzger, E. L., Simon, M., and Wineberg, H.: Examination of the Field of Vision in Pregnant Women. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxx, 140.

Fifty-six pregnant women were examined by the authors to determine whether the field of vision was changed in pregnancy. Despite recent claims to the contrary, the present authors could not find any diminution in the field which could be attributed to any disturbance in the region of the optic chiasm in a single patient. On the other hand, they did find functional deviations from the normal. The eyes during pregnancy readily show functional disturbances which remind one of the disturbances in hysteric and neurasthetic individuals.

J. P. GREENHILL.

Klaften: Contribution to the Knowledge of Pregnancy in Hemeralopia. *Zentralblatt für Gynäkologie*, 1923, xxxii, 1288.

Klaften reports observations on some dozen cases of hemeralopia developing in pregnancy, apart from the cases of hemeralopics who became pregnant. These are two distinct entities, as the hemeralopia of pregnancy appears to be a temporary condition, wherein the course and prognosis differs entirely from ordinary hemeralopia. It appears shortly before the end of the pregnancy, is unaffected by treatment, and disappears spontaneously after confinement. Recurrence of the disease in several pregnancies, and the observation that nonpregnant women suffer relatively infrequently from this condition in the childbearing age, suggests pregnancy as a causative factor. The author has made many attempts to determine the etiology of the condition, whether associated with altered function of the kidneys, liver, or cardiovascular system, but was unable to find any cause of relationship between disease of any single organ and the hemeralopia. On the other hand, many normal patients were examined during pregnancy, as well as many others suffering from various toxemias, and no trace of the affection was discovered. Under ordinary circumstances menstruation, or the associated function of the ovary, seems to account for the lessened tendency to hemeralopia of women in the childbearing age, and the disappearance of menstruation during pregnancy seems to be one factor in its production. Apart from this it is probable that the associated complex of alteration of various organs during pregnancy is a factor, and that hemeralopia is a manifestation of pregnancy toxemia.

LITTLE.

Schall, E.: On the Question of Bitemporal Hemianopsia in Pregnant Women. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxxviii, 75.

Recently Löhlein published a report in which claims were made that there is a pronounced bitemporal hemianopsia during the last month of pregnancy in 80 per cent of pregnant women. Schall examined 68 pregnant women to determine the validity of this claim, but he could not find a single woman who had hemianopsia. Schall attributes this difference to the fact that Löhlein's tests were carried out by an inexperienced man. Schall points out that for an hypophysis to produce pressure on the optic chiasm it must be large enough to produce changes in the sella turcica that can be recognized in a roentgen-ray plate. However, in pregnant women there is no enlargement of the sella turcica.

J. P. GREENHILL,

Fruhsholz, A.: Thyroparathyroid Insufficiency in Pregnancy. *Gynécologie et Obstétrique*, 1922, vi, 145.

The author considers thyroid insufficiency in pregnancy under the headings: (1) athyroidism and, (2) hypothyroidism in pregnancy, (3) surgical hypothyroidism in pregnancy, (4) medical hypothyroidism. He considers (a) pregnancy with slight hypothyroid syndrome associated with migraine, chronic rheumatism and asthma; (b) pregnancy with marked myxedema. He reports a number of cases with detailed observations of these various conditions. He has a large group with parathyroid insufficiency in pregnancy in which he considers tetanus and eclampsia. The author draws no definite conclusions from his observations. F. L. ADAIR.

Jung: Clinical Course during Pregnancy of an Enlargement of the Hypophysis. *Schweizerische Medizinische Wochenschrift*, 1922, lii, 61.

The case reported is similar to that of Fehr in which a bitemporal hemianopsia had resulted, due to pressure on the optic nerve by the enlarged pituitary body. Although the visionary disturbance had persisted since the enlargement early in the second pregnancy and was now of ten years' standing, there was no acromegaly, glycosuria or polyuria. Jung's case is similar. The bitemporal hemianopsia having developed during a tenth pregnancy. At the close of the seventh month the x-ray showed definite enlargement of the pituitary, the visual disturbance was profound and the papilla whitened to some extent. Pregnancy was interrupted and the woman sterilized. In three days the patient was able to recognize persons in the room although the visual disturbance had not cleared up. The rapid subsidence of symptoms suggest a physiologic engorgement of the hypophysis due to pregnancy or a latent adenoma rather than a gumma or a malignant newgrowth.

A. C. WILLIAMSON.

Löhlein, W.: Bitemporal Hemianopsia in Pregnant Women. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1924, lxxv, 129.

The author examined the fields of vision in pregnant women every week during the last two months before labor and found during the last four weeks a constant and definite bitemporal diminution. The greatest limitation in 78 per cent of his subjects was found at the time of labor. The diminution first affected the colors, especially red and green. The change was observed more frequently among older women and this was due to the fact that most of the multiparas were found in this group. The number of births had a definite influence on this restriction of the visual field. All patients showed a definite improvement about the tenth day postpartum and in 80 per cent of the primiparas the fields had returned to normal at this time. In multiparas there remained a definite and permanent limitation.

This phenomenon is due to a physiologic hypertrophy of the hypophysis during pregnancy. The hypertrophy begins during the fourth month of gestation, and retrogression can be observed macroscopically one week postpartum. In repeated pregnancies there remains an increased number of chief cells which produce an intensive hypertrophy of the hypophysis in subsequent pregnancies. Very rarely is there such a degree of limitation in the field of vision that the patient notices it.

J. P. GREENHILL.

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## Original Communications

### EXPERIMENTAL STUDIES ON THE TOXEMIAS OF PREGNANCY\*

CAN HISTAMINE POISONING BE REGARDED AS THE ETIOLOGIC FACTOR?

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#### I

UPON no problem in obstetrics has so much effort been expended as in attempts to elucidate the cause of the toxemias of pregnancy. Yet our insight into this field today is based upon but little more fundamental knowledge than it was two decades ago. The extensive chemical studies which have been made in recent years have thus far failed to afford an acceptable explanation for the basic phenomena. They have reflected the results of derangements which occur in various organs, but they have not thrown light upon the etiologic antecedents. There need be little wonder, therefore, that on several occasions it has been suggested that we should hesitate to discuss the existence of toxemias of pregnancy until the toxic agents concerned in their production have actually been demonstrated. "Toxemia is often a shibboleth of the profession. When a disease cannot be diagnosed, it is put down as a toxemia. This, however, is not medical science—it is medical shirking" (Macleod).

The work done during the last few years on the problems under consideration shows a tendency to consider their fundamental phenomena as beginning in the realm of physiology and ending in that of pathology. Thus, recent investigations tend to stress the problems

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of the normal and of the abnormal by widening, as comprehensively as possible, our present state of knowledge of the biology of pregnancy, particularly with regard to alterations in the liver function, the action of the ductless glands and their intimate relations with the vegetative nervous system. The numerous articles dealing with development of edema in various areas of the pregnant organism and with demonstrable changes in the behavior of the capillaries offer a good example of the progress in this field, which is concerned with physicochemical subtleties. But, there is a consensus of opinion that in the investigation of a problem of this nature, little real progress as to basic phenomena can be made until it is possible, either to identify positively the causative toxic substances or to reproduce in experimental animals the characteristic clinical syndromes, as well as the microscopic and chemical features of the toxemias of pregnancy.

The writer has chosen the latter mode of approach, and in the present study will give a brief report of the results obtained in several series of experiments and will offer such conclusions and applications as are based upon his observations, particularly as regards the clinical phenomena which occur in severe cases of *premature separation of the placenta*, *pernicious vomiting*, and *eclampsia*. "The ultimate object of all medical research is practice. In the final analysis the test of the value of any research is to be found in the application of the results" (Patterson). While the experiments were first undertaken in the hope of producing premature separation of the placenta in laboratory animals by the intravenous administration of histamine, for reasons referred to later it soon became apparent, after we had become acquainted with the notable structural changes in the liver and kidney resulting from the employment of this substance, that a number of additional investigations concerning other toxemias might be profitably undertaken by changing the experimental conditions. The animal experiments were conducted in the Pharmacological Department of the Johns Hopkins University, where I had the privilege of working with Dr. E. M. K. Geiling; the subsequent microscopic studies of the organs were made in the Obstetrical Laboratory. A preliminary communication dealing with the first part of our experiments, which were performed during May and June, 1925, was published in the February number of the Johns Hopkins Bulletin for 1926.

My special interest in histamine as a possible causative toxic factor in the production of premature separation of the placenta, was aroused by the microscopic study of sections obtained from uteri which were removed at operation or autopsy from women presenting that condition. As Williams points out in his recent paper, the lesions consist in intramuscular hemorrhage which leads to disassociation of the muscle fibers, and which is due to damage to the walls of veins of

small and moderate caliber; while outside of the hemorrhagic areas the muscular fibers are spread apart by edema. When the tubes and ovaries and broad ligaments are involved the hemorrhagic infiltration can be traced in places to similar changes in the periphery of small veins. These findings appeared to me to be indicative of the action of a poisonous substance which affects the vessels by making their walls permeable for plasma and corpuscles. Furthermore, upon taking into consideration the shock which develops in severe cases and which is frequently out of all proportion to the amount of blood lost, the picture of experimental histamine intoxication was called to mind.

In the attempt to reproduce premature separation of placenta by a mechanism similar to that observed in human beings, pregnant guinea pigs were chosen on account of the fact that placentation in that

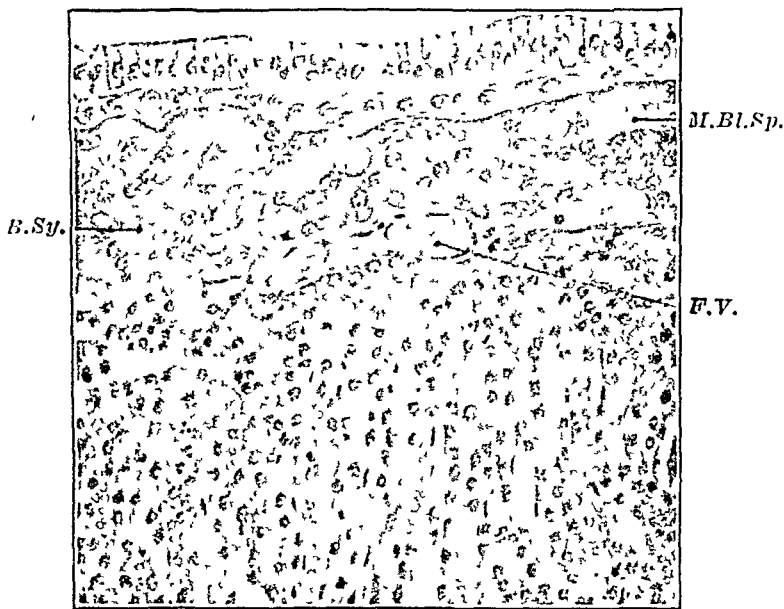


Fig. 1.—Section through margin of normal guinea pig placenta (Grosser). *F.V.*, fetal vessel; *B.Sy.*, border syncytium; *M.Bl.Sp.*, maternal blood space.

species exhibits a reasonable likeness to that of human beings, particularly in that the cotyledon is attached to the periphery—ectodermal giant cells and ectoplacental entoderm—by plasmodial roots suggestive of the fastening villi in the human placenta. Since the syncytial columns give rise to a meshwork containing maternal blood, they present a functional similarity to the intervillous spaces in the human placenta (Fig. 1).

The experiments were conducted upon 14 pregnant guinea pigs, most of them being in the last week, and only a few in the first half of pregnancy. No anesthetic was employed. Histamine was given intracardially in doses of 0.25 to 1.0 c.c. of a 1 to 1,000 solution per kg. of body weight, one to three injections being given at intervals of an hour. In those instances, in which repeated injections were given, the initial dose never exceeded 0.25 c.c. per kg. A marked difference in the sensitiveness of the animals toward histamine could be noted, and the degree of



Fig. 2.—Section through margin of guinea pig placenta after injection of histamine, showing damage to fetal septa, and distention of maternal blood spaces (end of four weeks).



Fig. 3.—Same as Fig. 2, except at term, showing greater damage to tissue and greater distention. *a*, syncytial blood spaces; *b*, ectodermal giant cells; *f*, ectoplacental entodermic layer; *c*, ruptured syncytial septa; *d*, free hemorrhage after extensive rupture of syncytial septa.

shock produced by the same dose varied greatly. The abdominal organs were removed after the animals had recovered from shock and were immediately hardened in 10 per cent formalin, and a few days later, cross sections through the pregnant uteri were made. The microscopic examination of the pregnant organ showed a striking picture; the invariable result in guinea pigs was that in different places the fastening plasmodial roots had become detached to a greater or less extent, and that the placenta had been in part separated from its basal tissue by hemorrhages. Thus, in various specimens, almost the entire basal area of a cotyledon lies free, and upon closer examination, it can be seen that the maternal blood spaces at its basis, which, as described above, normally present a dainty meshwork of plasmodial rootlets, had become dilated ad maximum. Since the delicate syncytial columns were unable to withstand the sudden increase in tension exerted by the enormous and paroxysmal dilatation of the maternal blood spaces, they were torn asunder or were broken off, and the previous normal connection between the cotyledon and the underlying tissue was interrupted. This mechanism becomes apparent by demonstrating that the free ends of the torn plasmodial roots, while still attached at one side, are floating in the effused blood. Since the same phenomenon has taken place in the maternal veins, which run in the connective tissue septa between adjacent cotyledons, their mutual connection is occasionally severed by hemorrhage or by enormously dilated, thin vessels (Figs. 2 and 3).

Occasionally, even in the area of a single cotyledon, a hyperdistention of maternal veins may lead to a local hemorrhage. Likewise, a striking dilatation of the capillaries and veins is noted throughout the entire generative tract, and in addition it is noteworthy that hyalin thrombi can be seen within the vessels in the uterine wall. Actual hemorrhage, however, only occurs in the areas in which the tissues in the neighborhood of maternal blood spaces are exceedingly delicate, as, for instance, at the base of the cotyledon. Similar conditions, likewise, account for the occurrence of widespread hemorrhage within the chorionic tissue in the placenta of carnivora.

Six additional experiments were performed in order to obtain information as to whether the action of histamine in the conditions under consideration may or may not be regarded as specific. By way of control, histamine-free peptone, pituitrin and adrenalin were administered intravenously to three groups of two guinea pigs, respectively, but in none of them did the placenta show any material deviation from the normal.

Since our studies aimed primarily to solve the problem of premature separation of the placenta, the injections of histamine were made in those species of animals whose placentation simulates to some extent that of human beings, and which in addition, are sensitive toward histamine. Pregnant monkeys, of course, would have been the ideal animals for experimentation; but since they could not be procured it was deemed wise to select guinea pigs for our experiments. Rats could not be employed, as they are not at all sensitive toward histamine. Nor could one expect to produce premature separation in carnivora by the same mechanism as in human beings, on account of the *labyrinthine* structure of their placentae, and particularly since the relations of the decidua and decidual vessels differ altogether from those obtaining in man—a point which is of decisive character, as will be shown later.

On the other hand, the immediate incentive to an investigation concerning the effect of histamine upon pregnant dogs and cats was supplied by the statements of Simonds, Mauthner and Pick, that,

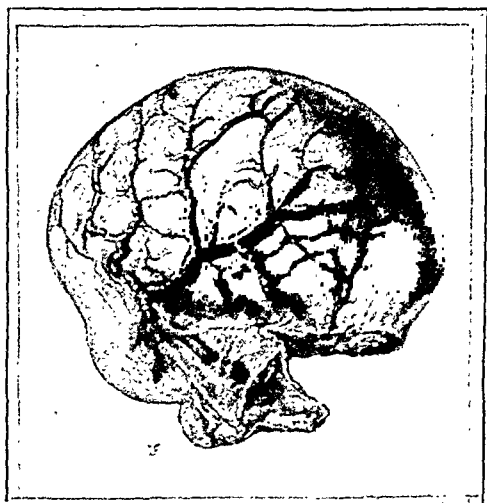


Fig. 4.—Uterine horn of pregnant cat immediately after injection of histamine, showing marked distention of maternal vessels.

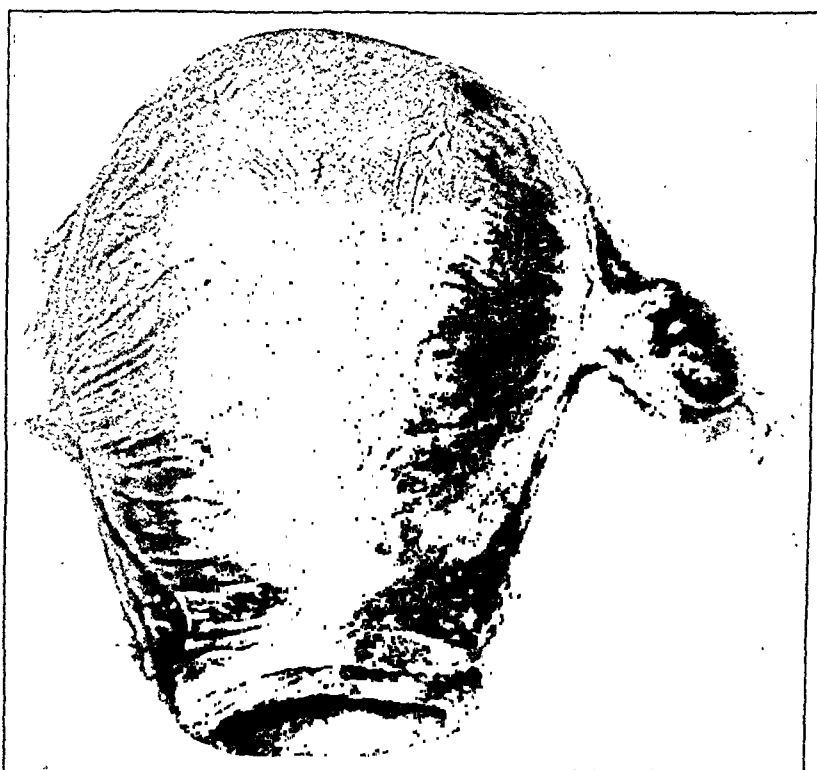


Fig. 5.—Human uterus removed on account of premature separation of placenta, showing distention of vessels and hemorrhagic lesions of uterine wall, and appendages (Williams).

owing to the fact that the hepatic veins in carnivora are especially rich in smooth muscle, there is a marked response toward histamine and peptone, as shown by the complete occlusion of efferent veins and

the temporary blocking of the escape of blood from the liver. Furthermore, it was felt that the direct observation of the processes occurring on the surface of the uterus and its appendages following

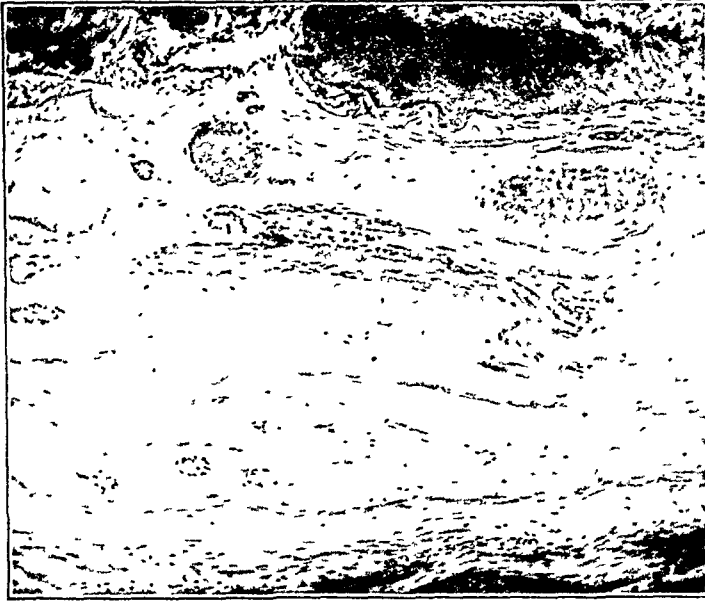


Fig. 6.—Section through wall of cat's uterus, showing separation of muscle fibers by edema. Note presence of clasmatoocytes.

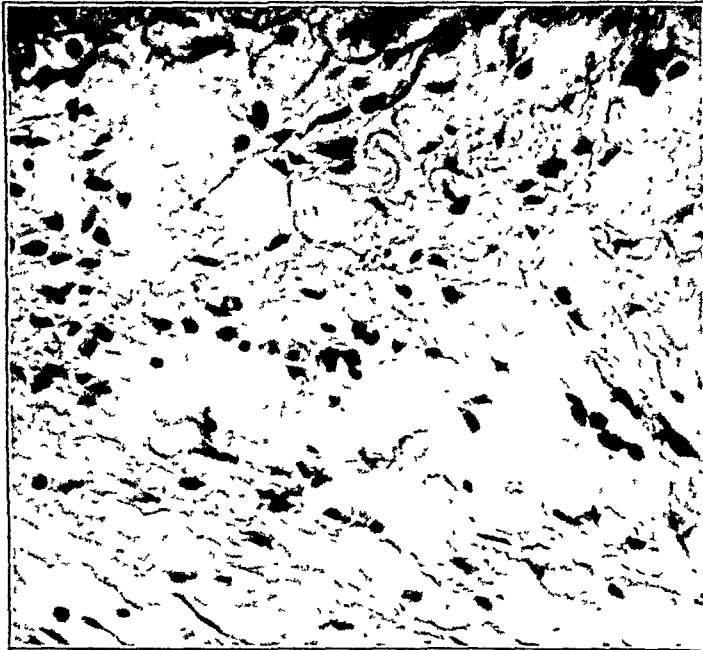


Fig. 6-A.—Higher magnification, showing throngs of clasmatoocytes.

the intravenous injection of histamine, would in all probability be more striking in larger animals. For this reason, a typical experiment of this group will be described.

A cat, in the second half of pregnancy, weight 2 kg., chloralose anesthesia intravenously. Ten minutes later the lower part of the abdominal cavity was opened

quickly, and the animal was kept in a warm water-bath. Then 1 c.c. of a 1-1,000 histamine solution was given intravenously. The uterus went immediately into tetanic contraction, and even the smallest venules on its surface became visible, while the larger vessels, as well as those of the broad ligament, became immensely engorged. At the same time, the animal passed into a condition of shock with a marked fall in blood pressure, from which it recovered after eight minutes. Thirty minutes after the first injection, a second dose of histamine twice as large as the first dose was given. In addition to the marked dilatation of the vessels, a number of purplish spots appeared at the ends of the several segments of the uterine horns. These spots did not disappear when the animal was sacrificed in good condition ten minutes later.

Fig. 4 illustrates the findings after the first injection of histamine. The uterine vessels are seen to be engorged with blood and present a picture similar to that



Fig. 7.—Wall of human uterus, removed for premature separation, showing disassociation of muscle by edema and hemorrhage. Note clasmatoocytes in the edematous area.

observed on the surface of human uteri in cases of premature separation of the placenta. (Fig. 5.) After hardening in 10 per cent formalin, the affected portion of the uterine horn was opened and a noteworthy phenomenon observed in its mucosa, namely, a conspicuous hemorrhage extending along the course of blood vessels corresponding to the purplish spots mentioned above. The placenta did not show any sign of separation. Upon histologic examination, the occurrence of a marked edema, which spread apart the muscle bundles, was a striking feature, resembling the conditions encountered in the human uteri. (Figs. 6 and 7.) Furthermore, the occurrence of clasmatoocytes in the edematous areas—quite similar to the observations of Williams on uteri removed for premature separation of the placenta—strengthened our conception that both conditions are closely allied. (Fig. 6-4.)

A few words concerning the findings in the uterine mucosa in the areas in which hemorrhage had occurred. The essential finding in

such areas is that the uterine glands adjacent to the placenta are filled with fresh blood, which in places has lifted up the covering layer. Under higher magnification, it was clear that red blood cells had made their way into the lumen from dilated capillaries beneath the glands by following the interstices between adjacent epithelium cells. In conclusion, it may be added that in some of our experiments, the abdominal cavity contained a variable amount of free fluid, which was very abundant in a few instances. This point appears to be of special interest, since our observations and the reports of others dealing with the findings upon opening the abdomen in cases of premature separation in women almost invariably mention the presence of a certain amount of free yellowish or bloody fluid.

Furthermore, we may mention the occurrence of petechial hemorrhages in various organs of the experimental animals, especially in the spleen and the pancreas. Our special interest, however, was aroused by the changes encountered in the liver and the kidney. While these lesions will be described in some detail in a later section of this paper, it may suffice to mention here that in carnivora the occurrence of peripheral liver necroses of the anemic and hemorrhagic type, associated with thrombi in the vessels, constituted a striking feature. Degenerative changes in the epithelium of the convoluted tubules of the kidney were an additional striking phenomenon.

Summing up the results obtained, we may say that the essential features of the clinical picture of premature separation of the normally implanted placenta, as it occurs in women, have been reproduced in pregnant animals by the intravenous administration of histamine: namely, the separation itself, marked shock, engorgement of the vessels of the uterus and broad ligament, uterine spasm, hemorrhages in various organs, and histologically edema of the uterine wall and degenerative changes in the liver and kidney. At the same time, it is clearly recognized on our part that in spite of so close a resemblance in the syndromes, our experiments cannot be regarded as conclusive until the presence of histamine or histamine-like substances has been actually demonstrated in the blood of patients presenting premature separation. As a matter of fact—as far as such evidence can actually be adduced—this must be regarded as the ultimate test of the validity of the conclusion that premature separation of the placenta is a histamine effect.

The recent work on the pathology of premature separation, in which the names of Couvelaire and Williams figure prominently, discusses at length the clinical phenomena of the condition and the anatomic lesions, with special reference to the hemorrhages in the uterine wall and the details of the vessels. Considering the etiology, Williams has disposed of various factors whose causative significance



had previously been emphasized in the considerable literature upon the subject, particularly the presence of inflammatory conditions in the decidua basalis and trauma, and he states: "As yet, we are entirely ignorant of the ultimate cause of the accident and can do little but speculate concerning it." Upon studying the older literature upon the subject, it was interesting to me that the view that the action of some chemical substance was responsible for the damage to the vessels, and was therefore the primary cause of the condition, had already been surmised by Spiegelberg, who stressed the significance of certain alterations in the vessel walls resulting from an unknown anomaly of the blood. The point to be emphasized here is that the preponderance of evidence now tends to show that premature separation of the placenta, from being a purely local condition, has become one which involves the whole organism, and a number of observations made in recent years, which indicate some association between accidental hemorrhage and eclamptic conditions, afford confirmatory evidence of the truth of such reasoning. Consequently, in the last decade the significance of a toxemia as an etiologic factor in at least the majority of the serious cases has been urged. "The chief argument in favor of this theory is based upon the sudden onset of the accident, its occasional occurrence in toxemic or eclamptic women, the occasional demonstration of degenerative lesions in the kidney or liver, but particularly upon the presence of albuminuria, in a large proportion of the patients" (Williams). At this juncture it may be noted that during the last few years a number of additional cases have been reported in which premature separation has occurred in patients who were under observation on account of pre-eclamptic toxemia or eclampsia. The opinion, therefore, that both of the conditions are closely allied, or perhaps identical, is gaining ground, so that it may be permissible to group such cases under the heading *Hepatotoxemia* or *Pre-eclampsia*. In this connection, the reader is referred to the articles by Portes, Le Lorier, Holmes, Scott, Gordon-Ley, Phaneuf, Heynemann, Fordyce, and Klasten. And our observations as to the experimental reproduction of characteristic changes in the liver and kidney accord well with such a view, but it is only fair to state that Williams does not feel that the evidence thus far adduced in the literature should be regarded as conclusive.

A satisfactory explanation of the mechanism which in all probability operates in the premature separation of the human placenta, seems to be afforded by the phenomena observed, which indicate that a sudden distention of the maternal blood spaces in the placental district accounts for the production of the accident under experimental conditions. We must recall that in our experiments hemorrhages occur in various regions as the result of special local peculiarities, par-

ticularly when the dilated vessels were supported by rather delicate tissues. The observation in premature separation of the human placenta that the decidual vessels have become dilated into enormous thin-walled sinuses, linked up with the statement that hemorrhage into the depths of the decidua appears to be the immediate factor in bringing about the detachment of the placenta, gives a clear hint as to the nature of the process. As Williams has pointed out, "It is only necessary for minute hemorrhages in the decidua basalis to coalesce in order to inaugurate the process which once begun will continue and be stimulated by the enclosed collection of blood acting as a foreign body." Frankl and Hiess, who hold that even the normal detachment of the human placenta is preceded by a distention ad maximum of decidual vessels and subsequent rupture, consider premature separation of the placenta as a pathologic condition which has its prototype in physiology, the difference lying solely in the fact that, in the latter case, the overfilling of the vessels takes place while the child is still within the uterine cavity.

Since from the above experiments it is clearly seen that there exists a suggestive analogy between histamine intoxication and the clinical phenomena of premature separation of the human placenta, a number of points of view from the therapeutic standpoint must be considered. In discussing shock in both conditions—premature separation and acute histamine intoxication—I point out that an overfilling of the vessels in the splanchnic area, associated with an increased permeability of the vessels for the escape of fluid, accounts for this accident. The very point that the volume of blood in actually effective circulation during shock is greatly reduced by these factors has been fully recognized only in recent years. This fact, however, has an important bearing upon the problem of early treatment which may be outlined here in skeleton form. The really vital matter in the treatment of shock consists in direct methods for restoring the blood volume and in the application of heat. The urgent immediate need of vascular fluid—according to the statements of the Medical Research Committee on Shock in London (1919), is effectively met by the transfusion of a sufficient quantity of blood or 5 to 6 per cent gum-saline solution. In order to obtain a more immediate response, transfusion of blood is preferable. Saline solution can be forced by rectum by the drip method. Accordingly, *transfusion* plays a prominent part in the treatment of premature separation of the normally implanted placenta, and I would suggest the delay of operative interference in severe cases until the effect of immediate transfusion has become well marked.

Before leaving this subject it may be well to discuss another point of clinical significance. The experimental work of Bayliss, Dale, and others indicates that ether, by virtue of its toxic action on the endothelium, greatly enhances the effect of histamine: an observation

which accords remarkably with the clinical experience that the administration of ether is most dangerous in persons who are threatened with shock and that its poisonous effect persists for some time after the anesthesia is discontinued. Furthermore, it must be borne in mind that any existing toxemia is greatly intensified by the administration of anesthetics. Consequently, if our conception of the ultimate cause of the *premature separation of the placenta* and of the *eclamptic condition* be correct, it would seem fair to conclude that *local anesthesia*—combined with nitrous oxide and the free use of *oxygen* should be the rational mode of procedure in patients presenting these accidents.

## II

Since the present studies are chiefly concerned with the poisonous effect of histamine, particularly in regard to the vascular system and the parenchymatous organs, a few remarks concerning the nature and the properties of this substance may not be out of place. The numerous researches and discussions on the subject in general testify to the live interest and vigorous development in this field, and I would especially refer to the brilliant work of Abel, Dale and coworkers. Histamine is derived by removal of the carboxyl group as  $\text{CO}_2$  from histidine, one of the most important building-stones of the protein-molecule, and is known to be formed as the result of bacterial activity in the intestinal canal. Its precursor originates as a product of the intermediate protein metabolism in animal tissues. A very slight modification of the protein molecule is sometimes sufficient to change it to a poison having the characteristics of the *histamine group*, which consists of a number of protein derivatives of unknown structure. "And the ease with which *histamine-like* substances are split off from cells of all kinds, inevitably suggests the preexistence of a grouping which can readily be detached by any influence which injures the vitality of the cells, and then is capable of producing the series of associated physiologic effects characteristic of histamine. The fact that extracts of so many organs and tissues contain substances exhibiting this type of activity, must have some physiologic significance. Evidence has been presented which reinforces the suggestion that action of the histamine type is one of genuine physiologic importance, in providing at least in many species, one side of the balanced chemical control of capillary tone, of which the other is provided chiefly by the natural secretion of adrenalin. The action of histamine on the blood vessels involves a dual mechanism, an increase in the tone of the arterial plain muscle and a relaxation of the tone of the capillaries" (Dale and coworkers).

Injected intravenously, histamine soon causes the arterial blood pressure to fall to the shock level, and the recognized failing output of the heart is considered as the result of two factors. In the first

place, much of the blood is withdrawn from the circulation by stagnation in dilated vessels (capillaries and venules) particularly in the splanchnic area; and in the second place histamine abolishes the tone of capillaries at the same time that it increases the permeability of their walls and thus permits the plasma to leak out. The only point needing additional emphasis concerning the action of histamine upon the vascular system, is that the evidence available goes to show that in the living animal larger doses of histamine are liable to produce vasoconstriction. (Dale, Kellaway, Ebbecke, McDowall, Rothlin.) And it should be added that histamine is known to act as a lymphagogue par excellence, and, in addition, to increase the excitability of the vegetative nervous system. Histamine is also a powerful agglutinator for human erythrocytes (Hanzlik). Its relation to the products of certain ductless glands (pituitrin, adrenalin, insulin) will be referred to in a later section of this paper.

After this digression, we return to our experiments and shall now discuss a series of further observations which were made incidentally upon the liver and kidneys of pregnant dogs which were subjected to repeated injections of small amounts of histamine for a considerable period of time. As we shall see later, these experiments were performed with the direct object of determining whether previous treatment with repeated doses of histamine does or does not affect the susceptibility of the arterial system toward adrenalin.

The following protocol illustrates the mode of procedure: Pregnant dog at term, weight 13 kg., received daily during the course of one week an intravenous injection of 0.5 mg histamine. Following the ninth injection, the animal gave birth to five well-developed living puppies. The next day, under ether anesthesia, blood pressure tracings were taken, and at the end of the experiment the animal was sacrificed and the abdominal organs immediately removed. The liver was normal in size but somewhat flabby and presented a strikingly mottled appearance and a yellowish color, which on section was found to extend throughout the organ. Fig. 8 represents the microscopic picture of the liver, and shows a widespread degeneration of the center of the lobuli. Closer study shows great variation in the extent of damage. A few cells appear to have undergone complete destruction, while in the vast majority the outlines of the nuclei, while still visible, are frequently pushed to the periphery of the cell. The cytoplasm appears either highly vacuolated or altogether transparent. Since the cells at the periphery of the lobules show but slight granular degeneration or present a cloudy appearance, the contrast between the clear central area and the darker peripheral zone is very striking. Moreover, frozen sections stained with sudan III reveal an intense fatty infiltration particularly in the central portion of the lobules; while faint, irregularly shaped spots in the center mark little necrotic areas. Glycogen has disappeared throughout, except for small remnants at the periphery of the lobules. Consequently the changes in the liver closely resemble those occurring in fatal cases of pernicious vomiting, as described by Williams, Hofbauer and others. A further similarity between such findings and those produced experimentally in our investigations is likewise presented by the kidney. As was pointed out in my monograph on the *Toxicoses of Pregnancy*, it is the epithelium of the convoluted tubules which exhibits marked

degenerative changes and stands out conspicuously if specifically stained for fat. Fig. 9 represents a section of kidney from one of our experiments; it clearly shows the changes. An additional link in the chain of evidence showing how closely the microscopic features in both conditions simulate each other, is afforded by the dilatation of the small and smallest vessels in the liver, as well as in the kidney.

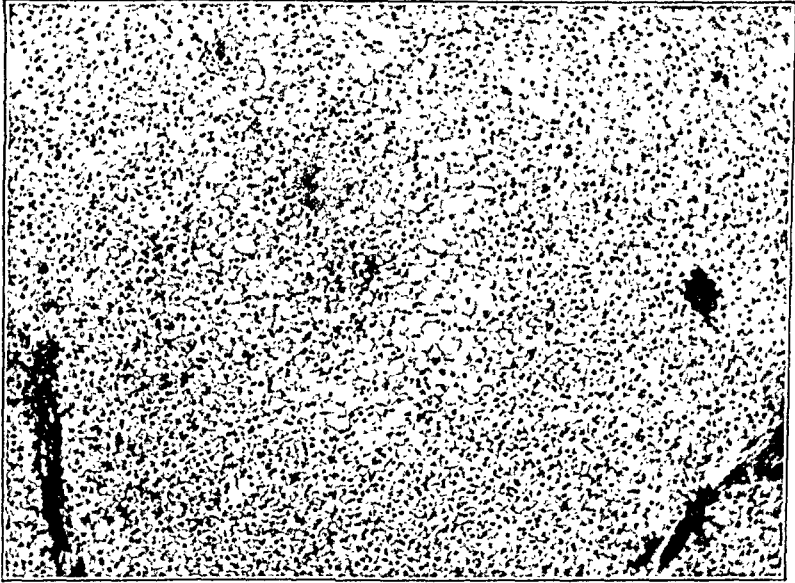


Fig. 8.—Liver of dog after administration of histamine for ten days, showing fatty infiltration of liver lobules.

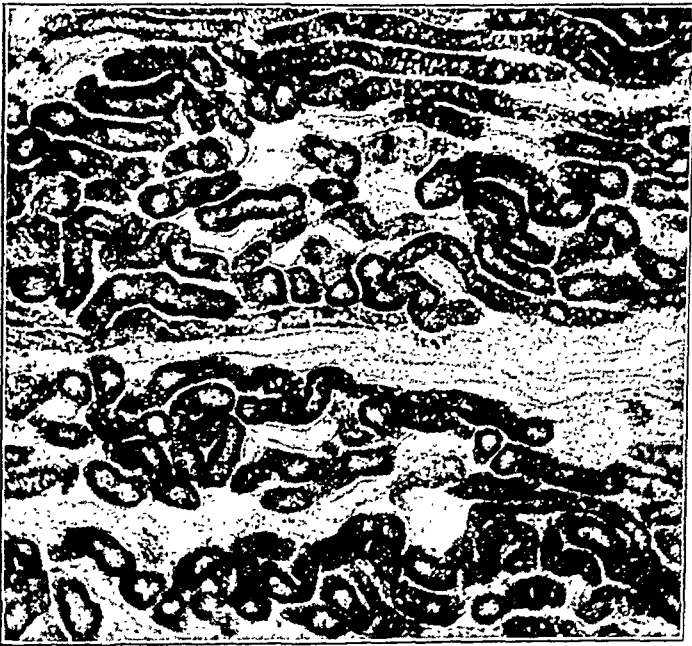


Fig. 9.—Kidney of same dog, stained with sudan III, showing fatty degeneration of convoluted tubules.

Whatever may be the final interpretation of the facts here recorded, a number of further data obtained in the investigation of histamine intoxication renders certain clinical aspects of the condition under

consideration more intelligible. When histamine is subcutaneously injected into carnivora a marked salivation soon sets in, and is accompanied by an increase of the secretion of gastric juice. Furthermore, experimental data are on record which show that histamine may act as an emetic, the stomach showing increased hypertonic contracture. To forestall objection, however, it should be stated frankly that the assumption that the clinical and the experimental phenomena are identical, should at present be regarded merely as a theoretical possibility.

Our special interest was focused upon the condition of the liver for the reason that many of the recent articles dealing with hyperemesis insist that glycogen deficiency of the liver dominates the clinical picture, and is even regarded as the etiologic factor concerned in the production of the condition (Harding, Titus, Thalhimer, Frey). It may be of interest to note that in my monograph on the subject, I was the first to point out the significance of glycogen deficiency in the liver and placenta, and that I suggested a functional test of the liver by using levulose.

Before leaving this subject, it may be well to state that Dr. Geiling and I are now conducting a series of experiments with the object of ascertaining whether the intravenous administration of insulin or glucose—when given for a period of two weeks simultaneously with histamine in the same doses as in the above experiments—will prevent the occurrence of fatty infiltration of liver and kidney. The immediate impulse for such experiments was furnished by the statement of Macleod and Noble that glycogenolysis due to adrenalin can be inhibited by insulin. While the results of our experiments are to be published in some detail on another occasion, it is interesting to note that microscopic examination of the organs shows that quite normal conditions of both liver and kidney are maintained when histamine and insulin are given simultaneously or in short intervals between each other. Glucose prevents to some extent the occurrence of necrotic processes in the liver. Thus, it appears that a hitherto unknown principle of insulin is in operation in this field of the economy of the organism. In the present preliminary report, however, we shall refrain from discussing the clinical bearing of these observations.

### III

In the first section of this paper, when referring to changes encountered in the liver and the kidney of carnivora in acute histamine intoxication, it was stated that information was available in support of the view that premature separation of the placenta is frequently associated with pre-eclampsia. The point to be emphasized here is that changes in the liver identical with those described as characteristic of eclampsia have not only been reproduced in response to his-

tamine, but also that the individual specimens show a variety of certain changes as is the case in eclamptic conditions. The noteworthy phenomenon is the occurrence of peripheral necrotic foci of both the anemic and of the hemorrhagic type. No explanation can be offered for the marked difference in the sensitiveness of various animals toward histamine. Nor is it clear why the response to the drug led to the anemic type of necrosis in one instance and the hemorrhagic in another.

*p.sp.*

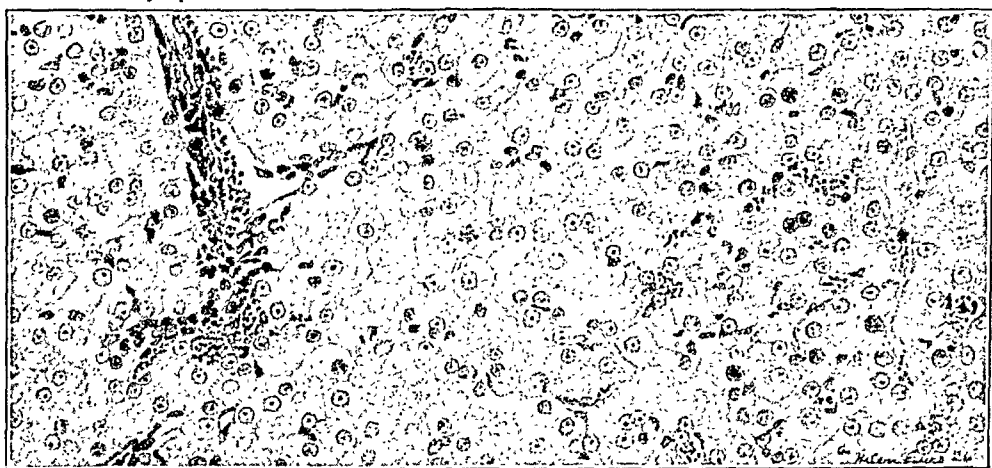


Fig. 10.—Liver of pregnant cat after acute histamine poisoning, showing necrosis in peripheral portion of lobule. *p.sp.*, portal space (Glisson's capsule).

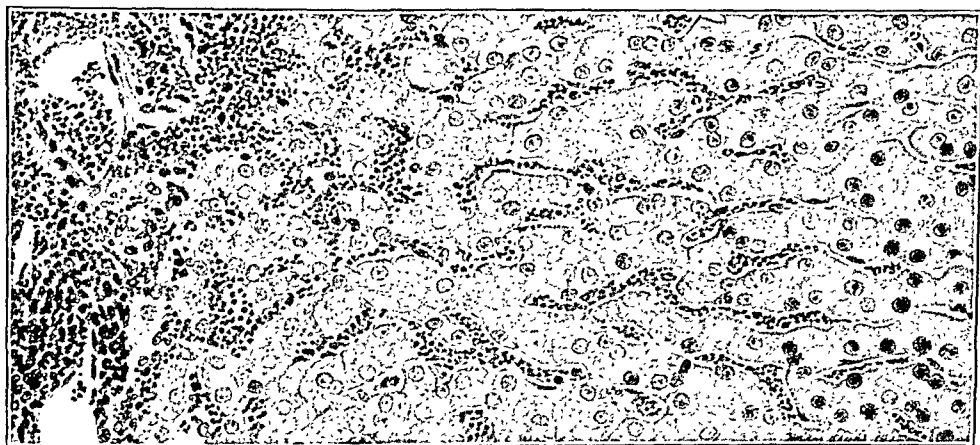


Fig. 11.—Liver of pregnant dog after acute histamine poisoning, showing hemorrhage into periportal space and necrosis in peripheral portion of lobule. Note dilatation of capillaries.

The changes in the liver are well illustrated in Fig. 10. This represents a section of the liver from the experiment described above (chloralose anesthesia) and shows a marked difference between the periphery and the center of the lobule. Even under low magnification the periphery is in general lighter and the structure of its tissue rather indistinct. Under higher magnification, the clear appearance of the zone is seen to be due to the fact that the cytoplasm has lost its granular structure as the result of a total vacuolization or a cloudy swelling of the cells, which is accompanied by an increase in their size. In some places, however, the nuclei of the liver

cells are invisible, while the boundaries of adjacent cells can hardly be differentiated. Moreover, a characteristic feature consists in a distinct increase in size of the Kupffer cells. Frozen sections stained with sudan III fail to reveal the presence of any noticeable quantity of fat within the degenerated areas. The conspicuous feature of Fig. 11, which represents a section of a liver from an experiment without anesthesia upon a pregnant dog practically at term, consists in extensive hemorrhages in Glisson's capsule. While the small arteries are completely constricted, the branches of the portal vein are dilated and about their walls hemorrhage has occurred, which in places extends into the periphery of the lobules. In such areas the liver cells have undergone necrosis, probably as the result of pressure exerted by the effused blood. Fig. 12 shows the topography of hemorrhagic lesions. In some places the development of thrombi can be observed—which are sometimes of the hyaline type, while others consist of clustered erythrocytes with platelets. Sections stained by the methods of Malloy, Koekel, van Gieson, now and then show the presence of

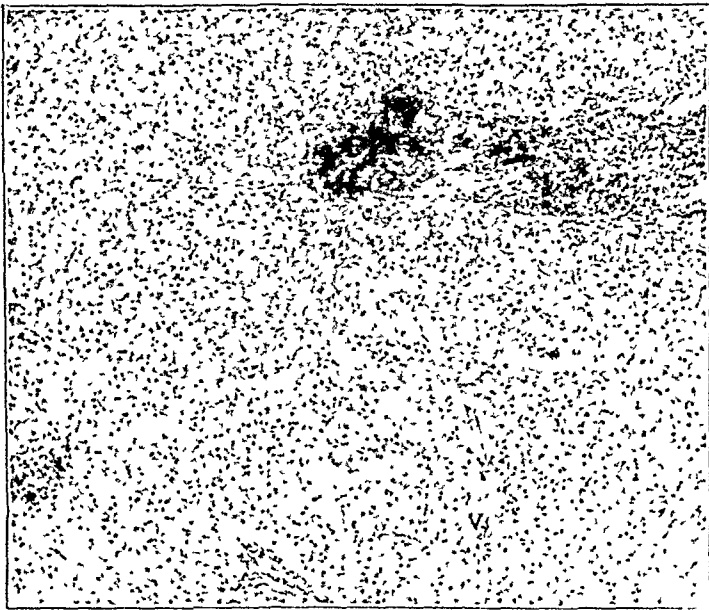


Fig. 12.—Photomicrograph of liver of Fig. 11, showing topography of hemorrhagic lesions. V., central vein.

fibrin in the degenerated areas. Another striking feature consists in a marked distention of the lymphatics in the connective tissue of Glisson's capsule similar to the observations in eclamptics.

The parallel between the lesions which we have described and those noted in actual eclamptic livers becomes even more suggestive when it is recalled that a definite precipitation of bile pigment can be observed within the liver cells in a number of instances, while in other places there is a marked dilatation of bile capillaries. In my monograph on the *Toxicoses of Pregnancy* I explained that we have to deal in eclampsia with a stagnation of the bile, and Fahr has recently insisted that bile stasis constitutes an essential feature of the eclamptic liver. This statement receives additional support from the observations of Gegenbach, Süssstrunk and Eufinger that the quantity of bile pigment in the blood of eclamptic patients is definitely increased.



The essential changes in the kidney consist of degenerative lesions of the epithelium of the convoluted tubules, which in some places is deprived of nuclei, and the occurrence of delicate fat droplets in the endothelium of the malpighian bodies. The capillary vessels are distended. Hyalin thrombi appear in various areas. Coagulated masses are to be found within the lumen of the tubuli, and in a few instances a number of erythrocytes are present (Fig. 13).

In seeking an explanation for the changes in the liver in acute histamine intoxication, a hint is possibly provided by the belief of B. Fischer that vacuolization of the liver cells should be regarded as a symptom of water-intoxication, which makes its appearance particu-

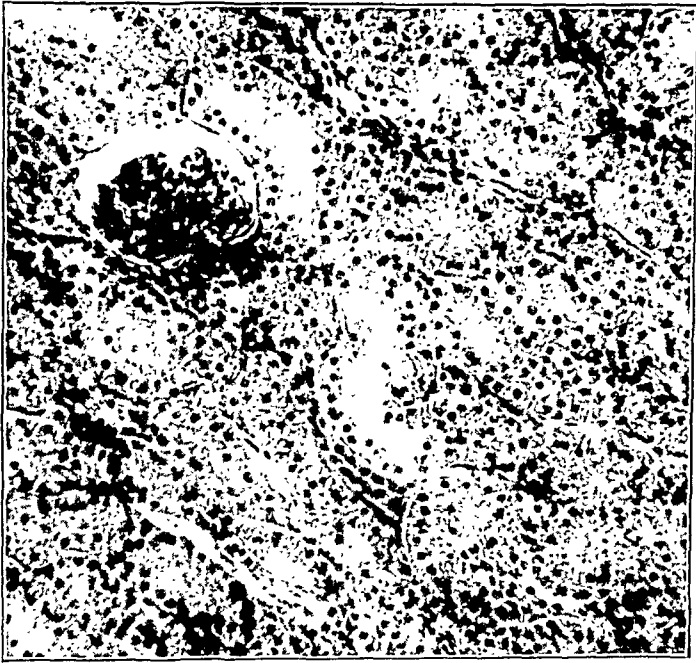


Fig. 13.—Photomicrograph of kidney of dog, whose liver is shown in Fig. 11, showing degenerative and necrotic changes in convoluted tubules.

larly in the periphery of the lobules, shortly after the ligation of the ductus choledochus.

Without considering all of the implications of our experiments, one point may be touched upon which is especially applicable to clinical conditions, and that is that we have to deal with a stasis of the bile. When we come to discuss the actual mechanism by which it is brought about, we should recall the fact that histamine, which is a smooth muscle stimulant in certain circumstances, causes contraction of the Oddi sphincter—a system of smooth muscle fibers at the entrance of the common duct into the duodenum. In this connection brief reference might be made to the observations of Westphal, who showed that in examining pregnant women by the duodenal tube, an increased irritability of the Oddi sphincter may be noted as a response to the

administration of pilocarpine. It would seem to be a matter of indifference whether the resistance noticed to the flow of bile into the duodenum is induced by the tonus of the muscle wall of the duodenum, or by the tonus of the sphincter of Oddi itself; but the practical aspect of the matter is that such observations may afford a plausible interpretation for the production of the epigastric pains, which are justly regarded as an important premonitory symptom in eclamptic conditions.

In our studies considerable attention has been given to another problem, namely, the cause of the elevation of blood pressure which occurs in pre-eclamptic and eclamptic conditions; and the possibility of correlating it to our new trend of argument. At first glance, the very fact that histamine is known to be attended by a marked fall in blood pressure seemed incompatible with the conception of an inverse reaction. The more, however, we began to study the subject, the more we met with authoritative statements that histamine, although a capillary dilator and capable of bringing about shock if absorbed in large quantities, may in certain circumstances evoke constriction of arterioles. First of all, as shown by Dale, histamine has a definite constrictor action on smooth muscle structures, and reference has already been made to a number of articles which stress its vasoconstrictor effect upon the systemic arterioles. Furthermore, the experimental work of Dale and Richards, Kellaway and Cowell, Backman and Hultgren, has disclosed the interesting fact that in the normal animal even a small dose of histamine accelerates the secretion of adrenalin. Moreover, Dale considers that a normal function of adrenalin is the maintenance of capillary tone against the depressor action of the products of cellular injury or metabolism. A similar view, as to the antagonistic effect of histamine and adrenalin on the capillaries, has been brought forward by Ebbecke, Krogh and others, who hold that pituitrin is likewise concerned in the maintenance of a normal equilibrium. Moreover, the experiments of Blau and Hancher tend to show that the absorption of histamine is correlated with increased influx into the cerebrospinal fluid of pituitrin. Furthermore, Kellaway's experiments go to show that histamine causes an increased output of adrenalin, and that adrenal insufficiency in turn results in hypersensitiveness to histamine, and a most recent paper by Burn and Dale emphasizes the point that there is sufficient evidence that a secondary *pressor effect* of histamine is due to accelerated output of adrenalin.

Our investigations have primarily aimed to obtain orientation as to whether an altered response to adrenalin can be detected in pregnant carnivora which had previously been subjected to the administration of small doses of histamine for a week or more, particularly in view of the claim of Hülse that peptones exert such an effect by rendering the

arterial system more susceptible to adrenalin, and that similar phenomena may be observed upon the application of eclamptic serum to isolated arteries. In our experiments, the pregnant animal (dog or cat), was given intravenously 0.5 c.c. of a 1:1,000 solution of histamine daily for seven to ten days. Then under ether or urethane anesthesia the carotid was dissected out, care being taken not to injure the vagi, and the cannula inserted into it by which the blood pressure could be recorded. After a suitable level had been attained, adrenalin (1 c.c. of 1:200,000 down to a 1,000,000 solution) was injected into a femoral vein. Histamine was then injected and another reading made to ascertain the effect of a similar dose of adrenalin. While the tracing shows that the first injection of adrenalin gave an inverse reaction (depressor effect), a second dose of adrenalin produced the usual and characteristic elevation (pressor effect), after the animal had recovered from the fall in pressure produced by histamine. Again there are some other observations on low blood pressure produced by histamine and the effect of adrenalin which raises the blood pressure, often for a longer time than would be expected from the dose given. The results obtained, however, are advanced with reservations, and only as subsidiary evidence that a change had occurred in the tone of the arteries. At the same time, our experiment offers a certain analogy to the statement made by Louros that adrenalin injected into eclamptic patients produces an inverse effect. These observations made clear the importance of the composition of the tissue fluids in determining the response to a well-known pressor substance.

A comment may be interjected here. It has been shown by Kylin and subsequently by various writers (Janssen, Kaufmann, etc.) that in essential hypertension the response to adrenalin is manifested by a primary fall of blood pressure and that the phenomenon is significantly dependent upon the electrolytes. That is, any change in the K/Ca ratio, which is normally 1.0 to 2.15, in favor of the preponderance of K, is accompanied by a reverse (*vagotonic*) type of adrenalin response. This observation is of interest from the fact that a similar alteration in the ratio of the electrolytes occurs in pre-eclamptic and eclamptic patients. Furthermore, Zondek claims that under experimental conditions the histamine effect is equivalent to a decrease of the calcium content in the tissues and can be counter-balanced by either adrenalin or calcium.

In reviewing the recent literature dealing with the problem of hypertension one can hardly escape the impression that its etiology is still an unsolved problem. There are, however, certain recent advances which have resulted from the active study in this field which deserve special emphasis: first, the recognition that the excess of pressure is conditioned mainly by functional variations in the tonus

of the arteries and arterioles, and that the general arterial constriction is due to an altered condition of the vasomotor centers in the midbrain (hypothalamic region) and in the medulla. Finally, as has already been mentioned, electrolytes may play a material part in the production of such conditions. The latter point has been especially elaborated by Kraus and his coworkers, who give their conclusions as follows: "There is an intimate relationship between the activity of the vegetative nervous system, the ductless glands and the electrolytes. The products of the ductless glands exert a definite influence upon the vegetative system, while the latter ultimately controls the action of the hormones. The distribution in the cells of the electrolytes being essentially controlled by both the hormones and the vegetative nervous system determines in turn the effect of the hormones. Endogenous poisons may act by changing the reciprocal proportion of electrolytes (K, Ca). The whole system of electrolytes in the body represents an entity, and their demonstrable changes in the blood are indicative merely of a derangement having taken place, which as a consequence may give rise to a variety of symptoms, for example, vasoconstriction."

While I feel that our conception as to the actual cause of the elevation of blood pressure, in both its systolic and diastolic phases, as far as the toxemias of pregnancy are concerned still remains inaccurate, yet considerable evidence as to the correctness of the view that it is due to a toxic alteration of the capillaries of the brain and vasomotor center has lately been brought forward by E. H. Starling. For this reason his statements will be quoted verbatim: "The arterial blood pressure is the resultant of two factors—namely the output of the heart and the peripheral resistance. The peripheral resistance is maintained by the tonic contraction of the arterioles, especially of the splanchnic area and is thus under the constant control of the vasomotor center working through the sympathetic system. Our recent experiments show that the vasomotor center is acutely sensitive to the slightest alteration in the blood flow through it. The smallest increase in this flow causes vasodilatation and therefore a fall of blood pressure, while the slightest decrease brings about general vasoconstriction and a rise of blood pressure, and these effects are permanent—that is, last as long as the alteration which is effected in the vasomotor center. All the mechanisms for the regulation of the activities of the heart and arteries are directed toward the maintenance of a blood flow through the capillaries in accordance with the needs of the tissues they supply. First among these needs are those of the vasomotor center and brain. There is evidence that in many parts of the body—perhaps in all—the capillaries are endowed with contractility, and this properly must be a considerable

factor in regulating the irrigation of the tissues according to their activities. Any such contraction of the capillaries to the vasomotor center would evoke an immediate response and rise of arterial pressure lasting as long as the contraction of the capillaries. But we know that the capillaries are susceptible to other chemical influences which alter their permeability—that is, the amount of blood fluid which filters through their walls. A familiar example of such a change is the wheals produced in the skin as a result of the injection of certain animal poisons or by the local injection of substances such as *histamine*. Any similar change in the capillaries to the brain would be fraught with evil results for the circulation through them; for it must be remembered that these capillaries run in a pericapillary lymphatic; increased exudation would cause a rise of pressure in the lymphatic and a corresponding narrowing of the lumen of the capillaries. *I would suggest that such a condition of altered capillary wall is responsible for the high arterial pressure which is the invariable concomitant of certain toxic conditions such as uremia and the toxemia of pregnancy.* In both of these, the high pressure I have ascribed to interference with the capillary circulation to the vasomotor center is accompanied by well marked signs of deficient circulation through other parts of the brain, such as headache, amaurosis, temporary loss of speech, various paralyses, and convulsions; and we know that in the toxemia of pregnancy at any rate, all these symptoms may subside with the termination of the pregnancy.”

Roberts likewise emphasizes the fact that a slight diminution in the blood supply stimulates the vasomotor center and furthermore points out that lactic acid—the presence of which in the cerebrospinal fluid of eclamptic patients has been demonstrated by Fűth and Lockemann in 1906—excites the vasomotor center to further activity. For more detailed information concerning the effect of a curtailment in the blood supply as a stimulant for the hypothalamic vasomotor center and for an adjacent center concerned with the discharge of epinephrin from the adrenals, the reader is referred to articles by Dresel, Houssay and Molinelli, Tournade and Chabrol.

With reference to the chemical findings in eclampsia, it should be mentioned that the writer has identified amino acids, lactic acid and purin-bodies in the liver (Monograph on *Toxicoses of Pregnancy*). Hence, the process has been designated by him as *partial autolysis of the liver*. It is the occurrence of autolytic processes in the liver which induced him to stress in that monograph the importance of discarding chloroform in operations upon eclamptics—in accord with the rules laid down by clinicians and pharmacologists that both chloroform and ether are contraindicated as anesthetics in any case of tissue damage in the liver (Osborne). In addition, the investigations of Stander and Radelet in this Clinic, which will soon be published, show that hyper-

glycemia, and an increase in lactic acid, uric acid and the inorganic phosphates in the blood constitute the essential changes in the eclamptic condition. Furthermore, similar changes have recently been reported in canine anaphylaxis and in acute histamine intoxication, by Chambers and Thompson. The exact significance of such alterations is still *sub judice*, but there is considerable evidence that they may be intimately connected with tissue damage in the liver. Should these observations be confirmed by further investigation, they would lend support to the view that the blood changes in the several conditions run parallel to the alterations in liver function.

Since the histamine effect and the anaphylactic phenomena so closely resemble one another in their clinical behavior as to be somewhat difficult of differentiation, and since certain investigators have attempted to explain eclampsia as an anaphylactic reaction, a few words concerning the problem may not be out of place. My experimental researches published in 1909 and 1910 indicated that the anaphylactic theory of the toxemias of pregnancy was not applicable, particularly because the injection of fetal serum failed to evoke anaphylactic reactions in pregnant and puerperal women. My conclusions were confirmed by a number of further investigations (Johnstone, Eisenreich, Murray, E. Zweifel and others), and it is now generally believed that this theory can no longer be maintained. On the other hand, it must be admitted that some color is lent to it by the fact that the histamine effect and the anaphylactic reaction, although not identical, do present certain striking similarities (Dale).

An interesting observation strongly indicating the occurrence of changes in the cell activities in eclamptic condition, has been published recently by Benda, who showed by means of the uranium and bromide technic, as well as by the hemolysin reaction, that the permeability of the meninges and of the choroid plexus is greatly increased in eclampsia. If these observations are confirmed, they would appear to indicate that the metabolism of the brain and the conditions of intracranial pressure might be materially interfered with and the occurrence of convulsions be favored. This conception receives additional support from the studies of Sioli on the small vessels in the brain of eclamptic patients. He found a fatty infiltration of the endothelial cells associated with definite swelling and proliferation of their nuclei. In this connection, it is interesting that in other organs—particularly in the liver, spleen, kidney and lungs—the occurrence of degenerative changes, or an actual swelling of the endothelial cells has of late been demonstrated, independently by Fahr and Domagk; these afford morphologic evidence of the action of a special endothelial toxin in eclamptic conditions.

That a leakage of plasma from the blood stream into the tissues actually takes place in eclampsia is indicated by the observations of

Zangemeister that the red blood count may increase to as high as nine millions, provided that the activity of the kidney has not been materially impaired. Furthermore, it must not be forgotten that histamine and pituitrin increase the osmotic pressure of the proteins, and by so doing, enhance the water-binding power of the tissue and promote the development of edema as shown by Ellinger, Molitor and Pick. And both of these factors, the osmotic pressure and particularly the degree of permeability of the endothelium, are materially involved in the mechanism of water-exchange between tissues and the blood stream.

In summing up, it is apparent that the supposed mechanism involved in the production of the phenomena observed in our experiments rests upon the action of a special endothelial toxin, which renders the capillaries more permeable to the escape of fluid. It would therefore appear that the histamine effect in all probability rests upon a physicochemical basis. At the same time this toxic substance is seen to act as a hemorrhagin and by changing the actual constitution of the blood to favor the agglutination of its red cells. In addition to the thrombosis, which may initiate the periportal necrosis of the liver, must be added the stagnation of the bile caused by the spasm of smooth muscular structures at the orifice of the common duct—the response to histamine.

In the light of the pathogenesis of eclampsia as set forth here, due consideration should be given to the following points of view in the treatment of this condition. In the first place, the occurrence of autolytic processes in the liver in eclamptic patients compels us to focus our attention upon those factors which are known either to retard or to hasten this process. In this respect, a diminution in oxygen supply is recognized as having an injurious effect upon living cells, particularly those of the liver and to add its ill effect to the deleterious action of substances like histamine, chloroform, ether. On the other hand, it is important to remember that an abundant supply of oxygen to the tissues in the first stage of autolysis decidedly retards the process, greatly lessens the after effects and aids recovery (Laqueur). Furthermore, want of oxygen calls forth an increased state of activity of the vasomotor center, resulting in a constriction of the peripheral arterioles (Starling), and in addition, excites the flow of adrenalin into the blood current which assists in the rise of blood pressure (Bayliss). Oxygen starvation also rapidly increases the permeability of the capillary wall (Bayliss) and promotes the elaboration of cerebrospinal fluid (Dixon). Finally, since the nerve cell shows a great dependence upon an abundant supply of oxygen, the damage of the nerve centers due to oxygen deficiency may impair the vital functions of the body. In addition, the administration of oxygen often acts as a primary cardiac stimulant. The advantages of a liberal and continu-

ous administration of oxygen in eclamptic conditions, based both upon laboratory findings and clinical observations, have been emphasized by the writer in 1912 in his monograph on this subject. Since the physiologic principles involved in this treatment are now better understood and my experience with this method has advanced, I am inclined to advocate the routine early administration of oxygen in severe cases of eclampsia as a valuable element in the program of the treatment—a safeguard against irreparable damage to vital organs. The length of time during which the inhalation should be continued, as a matter of fact, varies with the gravity of symptoms. The supply of oxygen is in some cases required for days. In other words, the liberal administration of oxygen is to be maintained until cyanosis practically disappears.

The importance of the administration of glucose in eclamptic conditions, as advised by Titus and others, is evident when we realize first, that glycogen disappears from the periphery of the liver lobules in eclampsia; and secondly, the changes observed in the liver during starvation, when superimposed upon eclampsia tend to increase the existing acidosis. Furthermore, the above-mentioned observation, that in experimental conditions the administration of glucose protects the liver cells against chemical damages, furnishes an additional basis for the valuable aid rendered to eclamptic patients by the administration of glucose. The therapeutic importance of glucose as a cardiotonic has been recognized in recent years.

#### IV

On several occasions I have intimated that a certain amount of conservatism is necessary in transferring conclusions from experimental results in animals to morbid processes in man. Consequently, it is perfectly reasonable to entertain doubt of the significance of histamine as the etiologic factor in the production of the toxemias as long as actual chemical demonstration of its presence in the circulatory fluid has not been adduced. The criticism, however, loses a part of its force when we remember that the normal activity of any hormone or other potent metabolic product is probably the result of the steady production of such minute amounts of the principle that they are difficult to detect even by the most delicate chemical reactions. In this connection it should be remembered that according to the experience of the pharmacologists the acute toxic dose of histamine is smaller than that of any amine which has been studied up to this time. Furthermore, when the substance is given slowly, far more than the acute lethal dose can be administered, since in such circumstances its toxic influence is decreased by disamidation and oxidation in the body of the animal. And histamine is readily taken out of the blood by the tissues. Consequently, the actual demonstration of the presence of



histamine in the blood would indicate a very acute poisoning, so that when the poisoning is somewhat prolonged, it could scarcely be expected that the presence of the substance could be demonstrated at all (Loeffler). Furthermore, it must again be remembered that pure histamine and the various substances in the *histamine group* have a similar biologic effect upon the vascular system.

As a test for the presence of histamine in the blood, a color reaction with p-phenyldiazonium sulphonate has been suggested by Hanke and Koessler, but its value has not been proved. Nor are the widely used biologic tests established upon a firm foundation. These are based upon the ability of histamine to produce contractions of the uterus and the small intestine of the virgin guinea pig, on one hand, and of the vessels of the perfused rabbit's ear, on the other. Such experiments caused Hüssy and his coworkers to claim several years ago that eclampsia, pre-eclamptic toxemia, and severe cases of hyperemesis were due to the presence of *biogenetic amines* in the blood; whereas in the serum of normal pregnant women they were unable to demonstrate the presence of any vasoconstrictor substance.

At the same time it might be mentioned that investigations which are being conducted in this department by Dr. K. C. Sun show, in certain cases at least, that the blood freshly drawn from pre-eclamptic and eclamptic patients before any treatment is instituted, does contain some substance or substances which increase the tonus and amplitude of the contractions of the uterus of the virgin guinea pig suspended in Tyrode's solution. Such an observation is the more remarkable, as it is conceivable that the presence of lactic acid, as demonstrated by Zweifel in the blood of eclamptic patients in 1906, might so alter the hydrogen-ion concentration of the blood as to produce a definitely inhibitory effect upon such contractions. The similarity of such a kymograph tracing and a tracing showing the characteristic histamine effect is demonstrated by Figs. 14 and 15.

I will now give my views as to the possible development of histamine in the pregnant organism, as well as to the biologic purpose it may serve. Histamine may come into play through various channels. In this connection, we would recall the fact that microscopic examination of the pregnant uterus demonstrates that at all periods of pregnancy varying amounts of fetal ectoderm—*syncytial buds*—are constantly being cast off from the periphery of the ovum and gaining access to the maternal circulation (Fig. 16). Since such structures must eventually break down and dissolve in the blood within the intervillous spaces, or elsewhere in the maternal circulation, it is readily understandable that their split products must come into local contact with maternal tissue. Abderhalden's test is based upon this phenomenon, and Guggisberg has isolated from the placenta a chemical substance

to which the guinea pig's uterus responds in the same way as to histamine. Therefore, it might be permissible to attribute the marked venous hyperemia of the uterine wall at least in part to the local action of histamine. If this is admitted, it is further conceivable that the local production of histamine might act as a growth-stimulating agent for the uterine musculature, particularly as there is evidence that under suitable conditions it may specifically promote growth of

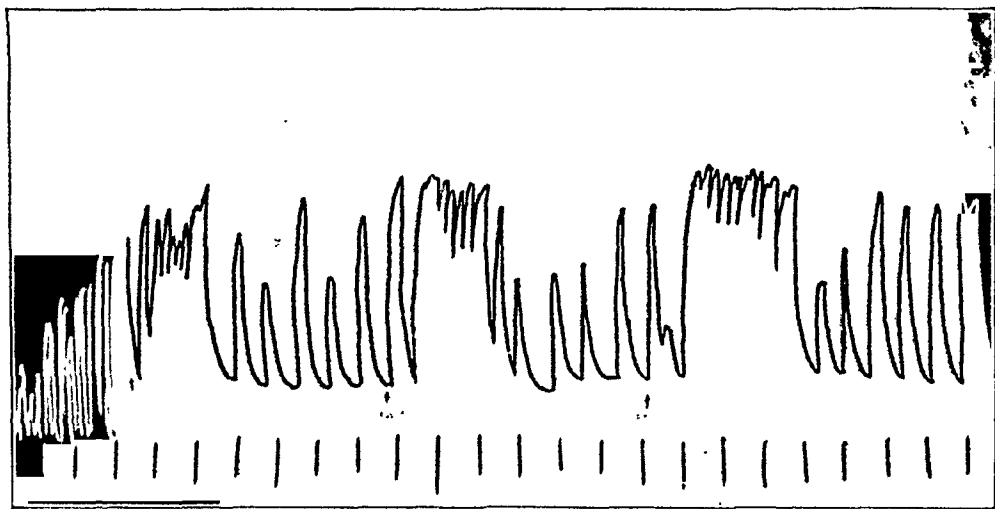


Fig. 14.—Kymographic tracing of contractions of guinea pig's uterus (half horn), after addition to Tyrode's solution of 0.25 c.c. of blood from eclamptic patient,  $\times \frac{1}{2}$  (Sun). Arrows mark time of addition.

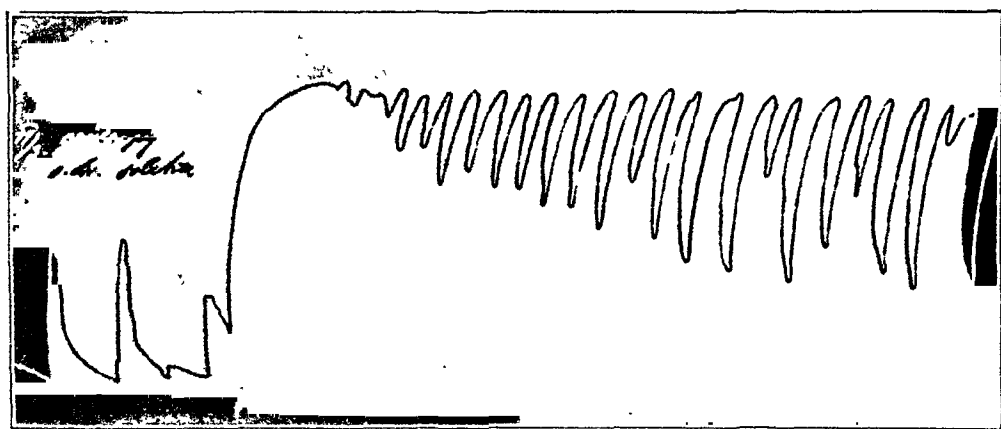


Fig. 15.—Tracing showing increase in both tonus and automatic contraction of guinea pig's uterus (whole horn) after addition of 0.0005 gm. histamine to Tyrode's solution  $\times \frac{1}{2}$ .

the genital tract (Robinson and Zondek). Again, the way by which adrenalin and pituitrin counteract the effect of histamine has already been discussed fully. Furthermore, there is another clinical phenomenon, for whose explanation no suitable theory has yet been advanced: Why does not the pregnant uterus always expel the product of conception shortly after impregnation? For under no other conditions does the uterus exhibit such tolerance to the presence of a

foreign body or an abnormal content. Not considering here the influence of the corpus luteum, the statements made by Fühner, Trendelenburg, and Nichulescu, that, after a previous dose of histamine, the uterine muscle either fails to respond to adrenalin or exhibits but a slight pituitrin effect may offer a clue towards the solution of this question.

Another area likewise concerned in the production of histamine is the posterior lobe of the pituitary body (Abel). Furthermore, it is a well-known fact that the breaking down of protein material in the intestines leads to the formation of histamine. Ordinarily, however, this does not gain access to the circulation. On the other hand, the idea has occurred to us that the protecting barrier presented by the intestinal wall may become insufficient when abnormally per-

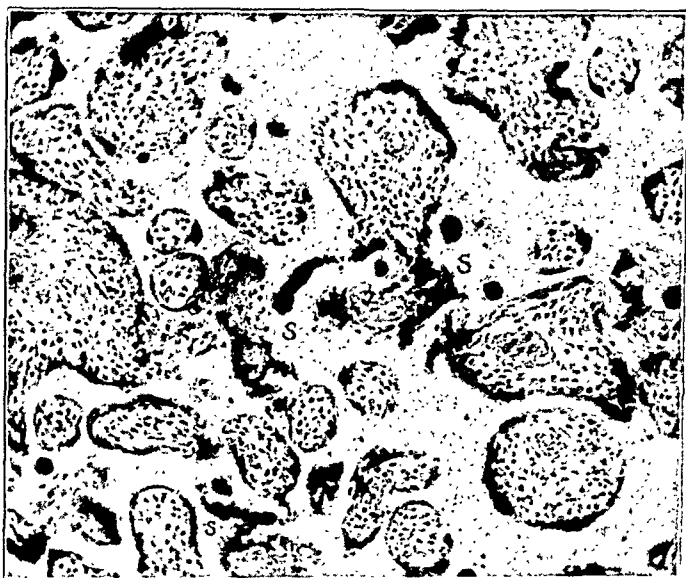


Fig. 16.—Section through human placenta at five months, showing syncytial buds. S., syncytial buds.

meable. We have attempted in a number of experiments to obtain information as to whether such a permeability of the intestines actually exists during pregnancy, but since these facts have not as yet been made clear to my complete satisfaction, I cannot, for the time being, commit myself to a definite opinion upon this problem. The significance of a higher degree of permeability of the intestinal wall, as a matter of fact, emerges from the experiments of McDowall and Worsnop, which show that constriction of arteries may be brought about if histamine is absorbed from the alimentary canal. "The importance of this latter observation lies in the fact that histamine is known to be a normal constituent of the intestinal content, and abnormal intestinal absorption is strongly suspected of bringing about conditions of arterial constriction in man." In this respect, it may be of interest to note that recently there exists a tendency upon the part of

internists to link up involvement of the kidneys with an abnormal absorption of amines from the intestinal canal. "It seems highly probable, from all the evidence that can be collected, that proteoses or the toxic amines, such as histamine, may be absorbed from the intestine and cause disturbances not only of nitrogenous metabolism, but also, temporarily, of renal functions" (Longcope).

#### SUMMARY

1. Following acute histamine poisoning in pregnant guinea pigs, a number of phenomena have been observed which are highly suggestive of premature separation of the normally implanted placenta as it occurs in women: the separation itself, engorgement of the vessels of the uterus and broad ligament, uterine spasm, hemorrhage into various organs, marked shock, and, histologically, edema of the uterine wall and degenerative changes in the liver and kidneys.

2. In carnivora, under similar conditions, histologic changes are produced which are suggestive of those found in women who died of eclampsia: peripheral necrosis of the liver (both of the anemic and hemorrhagic type) associated with the formation of thrombi and bile stasis, and in the kidney, degenerative changes in the epithelium of the convoluted tubules.

3. On the other hand, the administration of histamine to carnivora over a prolonged period results in changes in the liver and kidneys suggestive of those encountered in pernicious vomiting. Moreover, evidence has been adduced to show that the production of such changes can be prevented by the simultaneous administration of insulin.

4. The relation of histamine intoxication to the electrolytes in the blood, to the activity of the adrenals and the pituitary, and to the vasomotor center in the midbrain are discussed, and a possible explanation for the occurrence of hypertension is offered.

5. The striking similarity regarding blood chemistry in eclampsia and acute histamine intoxication, is emphasized, and local anesthesia is suggested as the procedure of choice in operations for premature separation of the placenta and for eclampsia. Transfusion forms an integral part of treatment in severe cases of premature separation of the normally implanted placenta. The liberal administration of oxygen—combined with an appropriate supply of glucose—is advocated in severe cases of eclampsia.

6. The possible sources of histamine during pregnancy and its biologic significance are discussed.

7. Finally, it should always be borne in mind that pure histamine and the various substances in the *histamine group*—a number of protein derivatives of unknown structure—have a similar biologic effect upon the vascular system.

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I desire to express my appreciation of the excellent work of Misses Edith Marks and Helen Lewis of the Art Department of the Johns Hopkins Medical School in the preparation of the microscopic drawings and also of Mr. O. O. Heard of the Carnegie Laboratory of Embryology in the preparation of the photomicrographs.

## THE USE OF IODINIZED OIL (IODIPIN) AS A DIAGNOSTIC AID IN GYNECOLOGY

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UNTIL a few years ago diagnoses in gynecology were made only by clinical examination and by a histologic and pathologic study of the tissues removed at operation. Pneumoperitoneum and x-ray studies of the pelvic organs, with a view of visualizing the organs were later advanced. Then Rubin perfected the technic of inflating uterus and tubes with oxygen or carbon dioxide by the vaginal route and thus gave us the best available diagnostic aid in sterility, ascertaining obstruction in the tubes, etc. It was then suggested that in cases of obstructed tubes, injection of a solution of sodium bromide, followed by x-ray examination, would exactly locate the obstruction and thus enable us to determine the best mode of treatment for curing the sterility. In some cases, however, disagreeable reactions have been reported from the sodium bromide injections, and its use has been limited.

In 1922, Sicard and Forestier,<sup>1</sup> of Paris, after much experimenting with lipiodol (40 per cent solution of iodine in poppyseed oil) and finding that it was nonirritating to the most delicate tissues, employed it for the localization of tumors of the spinal cord. In many cases

they injected 1 to 2 c.c. of lipiodol into the spinal canal seemingly without any injurious effects.

In 1923, Sergeant and Cottentot<sup>2</sup> first studied dilatations of the bronchi and bronchiectasis in adults by intratracheal injections of



Fig. 1.—This is a case in which the uterus, tubes, and ovaries were normal in every respect. The injection was made so that one could see the size of a normal uterine cavity and tubes. It is interesting to note the extremely small lumen in the fallopian tubes. A. Speculum. B. Uterine cavity. C. Normal tubes. D. Excess iodipin—tubes open. E. Excess iodipin behind uterus.



Fig. 2.—A case in which the uterus and tubes are normal. The uterus is displaced to the right of the median line by an ovarian cyst about the size of an orange, situated to the left of the median line. A. Speculum. B. Uterine cavity. C. Excess iodipin—tubes open. D. Excess iodipin behind uterus.

lipiodol through the cricothyroid membrane and reported no ill effects from its use. About the same time Armand-Delille<sup>3</sup> and his associates applied the same method in children.



Fig. 3.—A case of chronic subinvolution of the uterus. The uterine cavity is greatly enlarged. About 10 c.c. of iodipin were required to fill the uterine cavity and both tubes. This illustrates the importance of a pelvic examination before making the injection. If one did not know the size of the uterus, he might inject insufficient solution and thus be unable to interpret the reading properly. A. Cervical canal. B. Enlarged uterine cavity. C. Excess iodipin—tubes open.

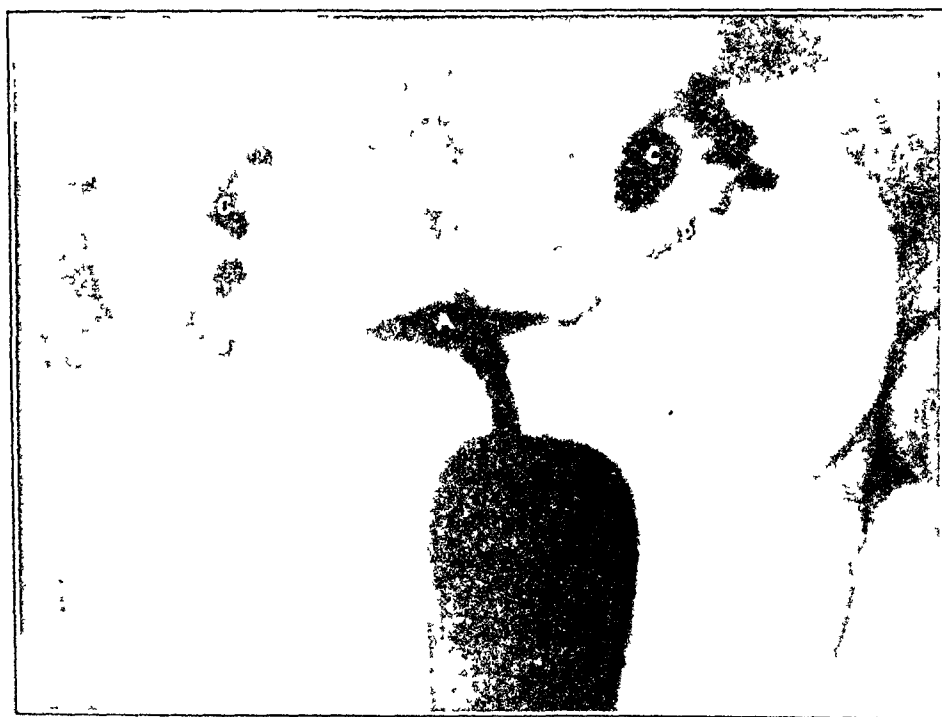


Fig. 4.—A case of acute salpingitis with pelvic abscess formation. The dilated, ambrinated extremities of both tubes denote an acute inflammatory process. The pelvic abscess was drained by vaginal section and the recovery was uneventful. A. Normal uterine cavity. B. Lumen of the tubes enlarged. C. Excess iodipin—tubes open.



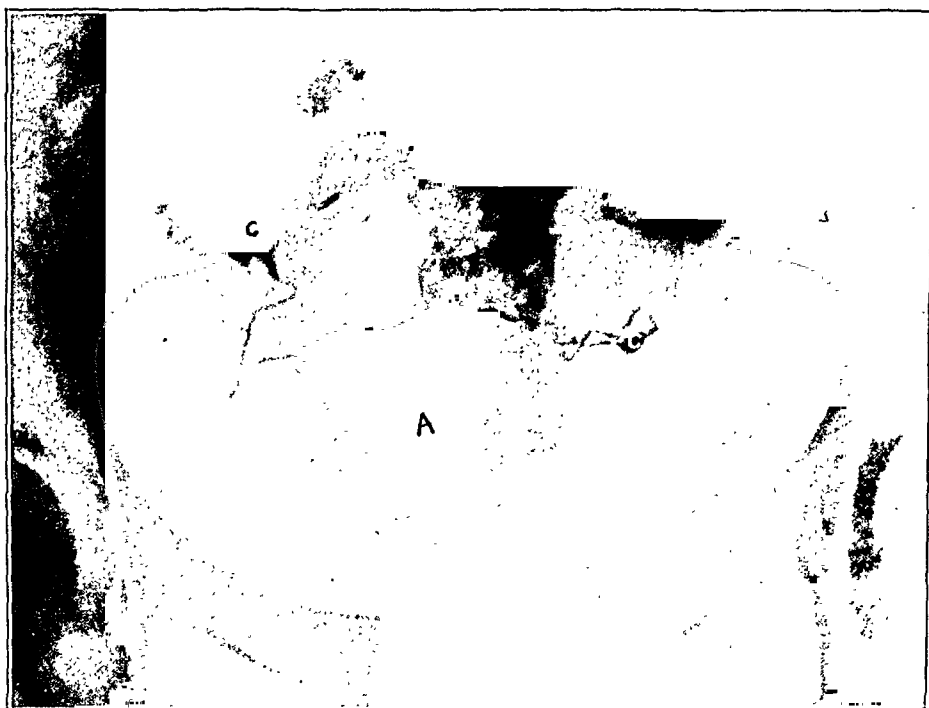


Fig. 5.—A case of chronic subinvolution of uterus with retrodisplacement. Note the enlarged uterine cavity with some irregularities throughout. Both tubes are open. The posterior position of the uterus is not demonstrated in this picture, as it is made in an anteroposterior position. A. Enlarged uterine cavity. B. Normal tubes. C. Excess iodipin—tubes open.



Fig. 6.—A case of a hatpin in the abdominal cavity as a result of an attempted abortion. Note that the uterine cavity and both tubes are normal in every respect. There is an excessive amount of iodipin in the abdominal cavity, as in this case too much of the solution was injected. A fistulous tract is seen where the pin perforated the uterus at its lowermost segment. At operation the pin was found imbedded along the vertebrae retroperitoneally. A. Speculum. B. Uterine cavity. C. Uterine sinus. D. Normal tubes. E. Excess iodipin—tubes open. F. Hatpin in the abdominal cavity. (An excess of iodipin was used in this case.)

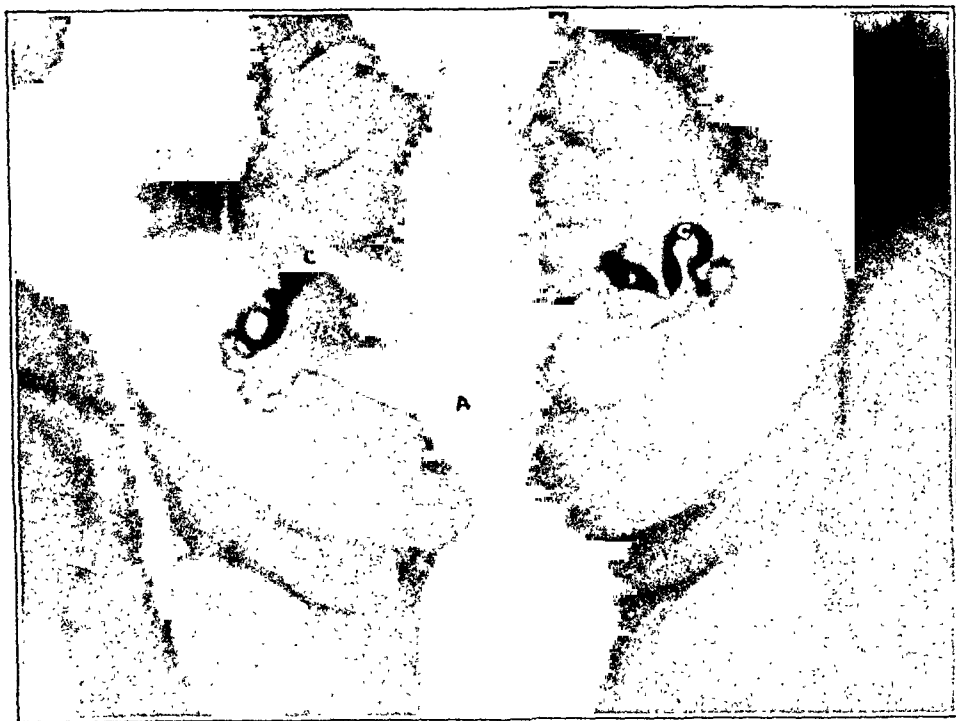


Fig. 7.—A case of pulmonary tuberculosis. Patient had tenderness about both tubes, with no history of pelvic infection, and clinically had all symptoms of tuberculous salpingitis. Both tubes show several heavy spots which may be tubercles, and if such is the case, would be very suggestive of tuberculous salpingitis. This patient would not consent to operation, and the findings were not confirmed. A. Uterine cavity. B. Tubes; note heavy spots throughout tubes suggestive of tubercles. C. Excess iodipin—tubes open.



Fig. 8.—Case is one of retrodisplacement with sterility. An examination of both tubes showed infiltration and fixed and clinically diagnosed chronic salpingitis. This case illustrates the value of sufficient iodipin to fill the uterine cavity and both tubes. On the right side the tube is open, and the iodipin has passed into the peritoneal cavity. On the left side the tube is closed at its end, forming a club tube. The ligaments of the uterus were shortened, and plastic work was performed on the left tube. When the club end was excised, iodipin escaped from the tube. A. Uterine cavity. B. Tubes. C. Obstructed left tube at infundibular portion (club tube). D. Excess iodipin—right tube is open.

In October 1925 David H. Ballou<sup>4</sup> of Montreal in a preliminary report on the use of lipiodol in lung conditions, stated that it was



Fig. 9.—Case of subinvolution with retrodisplacement of uterus in which the right tube was open and the left tube closed. At time of operation the left tube was so badly adherent that it was impossible to do plastic work. It was, therefore, removed. A. Enlarged uterine cavity. B. Excess iodipin—right tube open. C. Obstructed left tube, partially at ampulla, completely at infundibular portion.

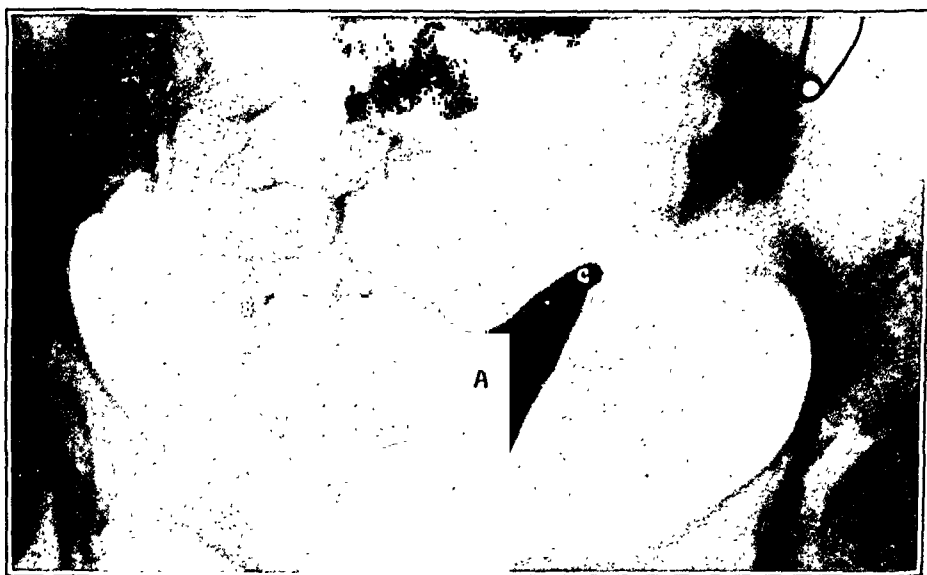


Fig. 10.—A case of bicornuate uterus with obstruction of both tubes. Illustrates beautifully the irregular uterine cavity. At operation both tubes were removed, as it was impossible to relieve the obstruction. A. Uterine cavity. B. Obstruction of right tube at its junction with uterus. Note the rounded appearance at point of obstruction on left (C).

rapidly eliminated by coughing or absorption from the alveoli, and that no ill effects were noticed.

In the early part of this year, 1926, Dr. Forestier came to this country and demonstrated his uses of lipiodol. While he was in

St. Louis, I had the pleasure of meeting him and of attending one of his demonstrations. He explained how useful in various ways lipiodol proves in the diagnosis of spinal cord and chest conditions and

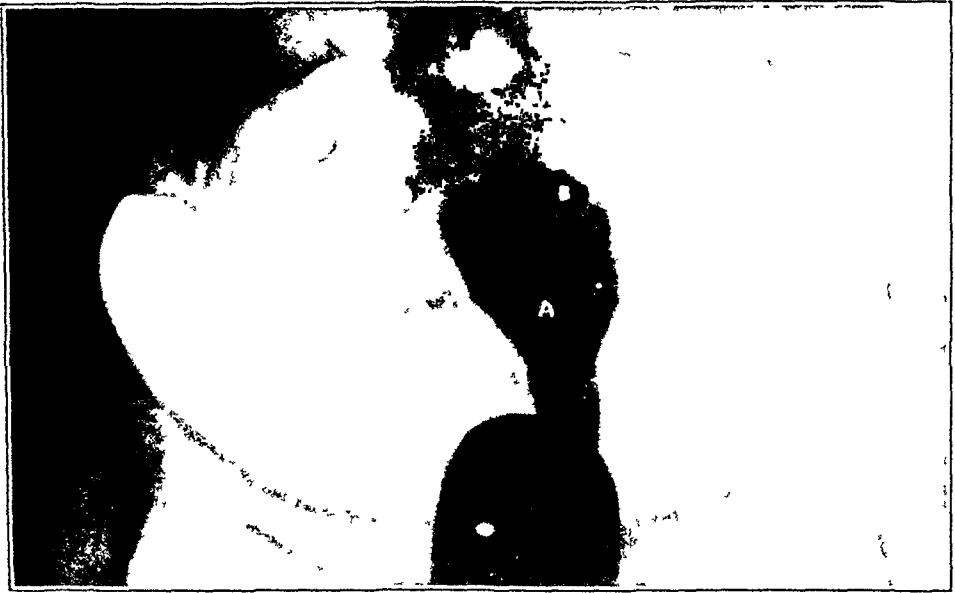


Fig. 11.—A case of acute endometritis following an abortion several weeks previously. Note irregular uterine cavity with obstruction of both tubes. Immediately following the iodipin injection a curettement was performed and the endometrium showed acute endometritis. No decidua or villi were present. Recovery uneventful. A. Enlarged uterine cavity. B. Obstruction of tubes at their junction with uterus; note the irregularity of the uterine cavity, possibly a disturbance of the mucosa.

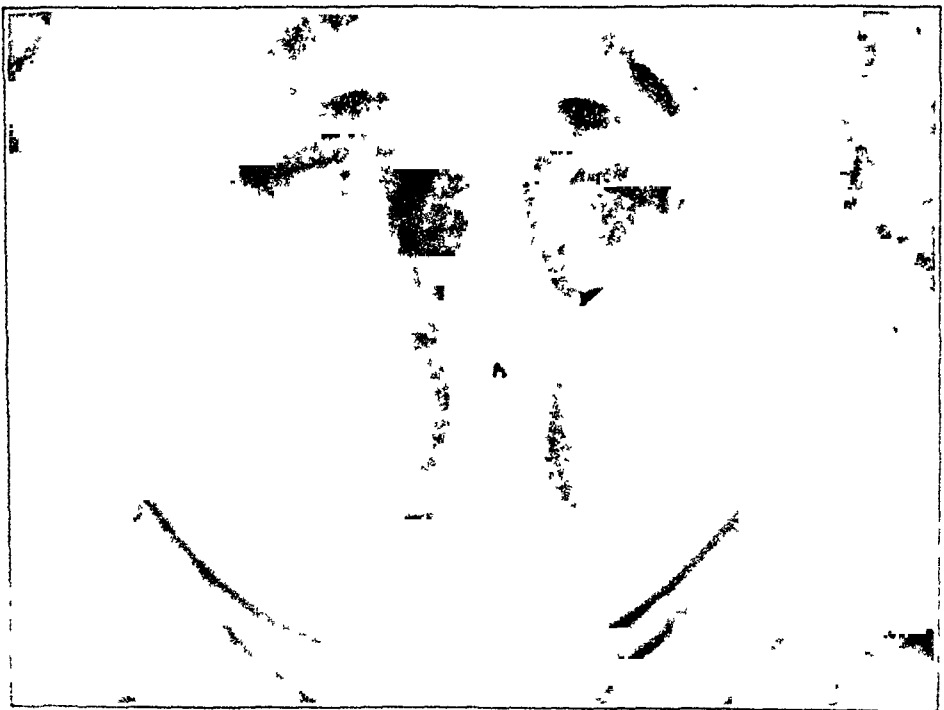


Fig. 12.—Case of enlarged uterus with obstruction of both tubes at their interstitial portion. Note enlarged uterine cavity both in length and breadth. The uterus showed marked enlargement; a supravaginal hysterectomy with removal of both tubes was performed. The pathologist's report showed diffuse adenomyoma of uterus. A. Elongated and enlarged uterine cavity. B. Obstruction of both tubes at their junction with uterus.

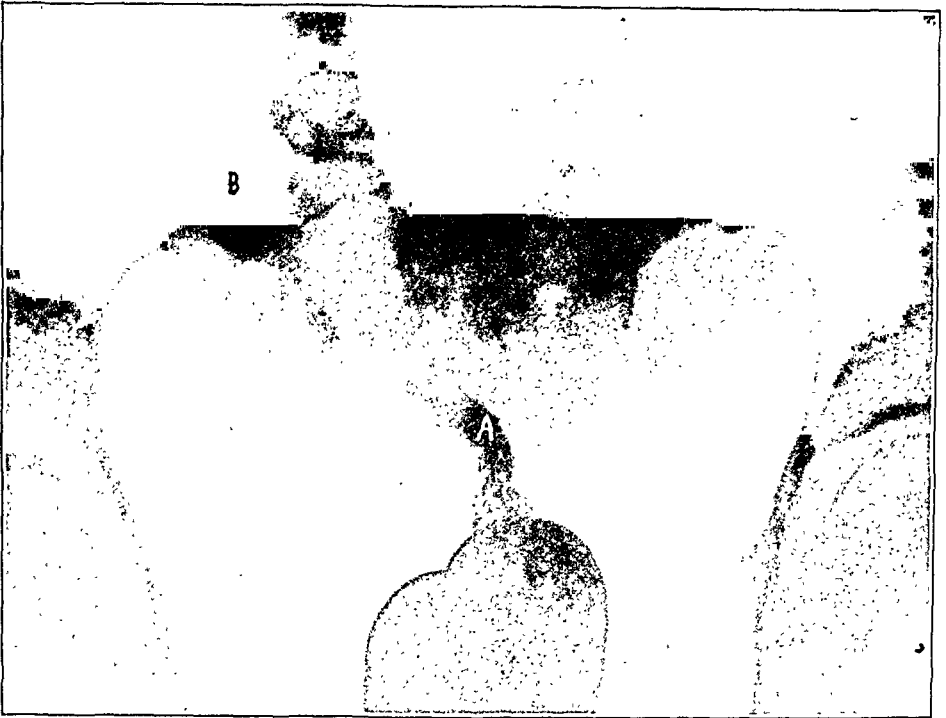


Fig. 13.—A case in which the pelvis was filled with many masses, and in order to locate the uterine body an injection of iodipin was made. Note the uterine cavity elongated (A) and terminating in a broad expansion in the right side of the pelvis (B). At time of operation supravaginal hysterectomy was performed and the uterus contained many myomas, the largest of which was about the size of an orange. Such a picture helps to make a diagnosis where several masses are present, and one would like to know their origin, whether uterine or ovarian. A. Cervical canal. B. Elongated, enlarged uterine cavity.



Fig. 14.—A case of chronic salpingitis and left ovarian cyst. The pelvis in this case was blocked by a mass about the size of an orange, which extended well down in the culdesac. This was thought to be a case of fibromyoma of the uterus, but at the time of operation the large mass was found to be a left-sided intraligamentous cyst. Note that iodipin shows a normal uterine cavity with right tube normal and open at its fimbriated extremity. The left tube is prolapsed behind the fundus, and the fimbriated extremity is not seen, but there is an extravasation of the iodipin about the ovarian cyst. This is an unusual picture, and its interpretation is vague. A. Uterine cavity. B. Tubes. C. Excessive iodipin—right tube open. D. Ovarian cyst in culdesac; excess of iodipin from left tube extravasated about ovarian cyst.

showed in a few slides its application in diseases of the female genitalia, of the genitourinary tract, of sinuses, etc. I was greatly impressed by these demonstrations and immediately started to investigate its use in gynecologic patients at the Barnes Hospital.

The French preparation, "lipiodol," is rather expensive and its supply is limited in this country. Iodipin (a 40 per cent solution of iodine in vegetable oil) manufactured in this country, is readily available and not very expensive. The pictures shown in this paper are all made from injections with iodipin. So far I have failed to notice any immediate reaction and I believe that it is not irritating to the tissues of the pelvis. The legends under the illustrations give the interpretation of facts easily recognized in the pictures. In most instances the findings were fully confirmed by a later operation.

The rather simple technic employed is as follows: The patient comes to the hospital for injection and x-ray exposure, but is allowed to go home immediately after the procedure. Some few complain of

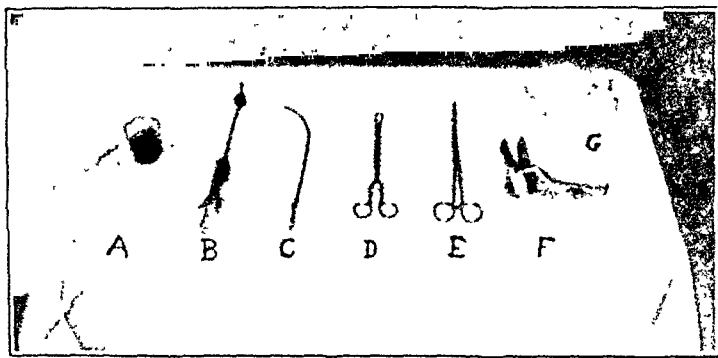


Fig. 15.—The necessary equipment for an iodipin injection. A. Tincture iodine. B. Luer syringe and cannula charged with iodipin. C. Uterine sound. D. Tenaculum forceps. E. Uterine dressing forceps. F. Graves' bivalve speculum. G. Cotton balls.

abdominal cramps during the injection; however, the discomfort lasts only a few minutes. The patient is clad in a nightgown and placed on the x-ray table in the lithotomy position. Everything is made ready for the x-ray plate, since the picture must be made as soon as the injection is finished. A Graves bivalve speculum is inserted, exposing the cervix; the field is painted with tincture of iodine, then the posterior lip of the cervix is seized with a tenaculum forceps and drawn down slightly. A sound is introduced into the uterine cavity to rule out any obstruction; the cannula (a Keyes-Utzman urethral cannula, modified and equipped with a rubber tip which acts as a plug against the external os [Fig. 15]) is inserted into the cervical canal for about 2 cm., and firm pressure is made against the cervix. With a 15 c.c. Luer syringe, about 7 c.c. of the iodinated oil are slowly and gently injected into the uterine cavity. When it is found that the injection can only be continued under pressure, it is evident that the capacity is filled; the x-ray picture is now made. When the

cannula is withdrawn, a great portion of the iodinated oil escapes from the uterus. The patient is allowed to get up from the table, dress, and go home.

For the sake of brevity I shall not requote the various findings made; they are noted in the legends.

In the 38 cases injected in the course of three months, I have not observed one single unfavorable reaction. I had occasion to open the abdomen in 30 of these cases at various intervals, from one to fourteen days after the injections, and I have not seen any irritating effects of the iodinated oil, which has passed through the tubes, on the tissues of the pelvis. Iodinated oil apparently remains unresorbed in the pelvis for a considerable time, and this is a point to be kept in mind to avoid misleading errors if at a later time x-ray pictures are made on the same patient for a gastrointestinal diagnosis, etc. I do not feel that any chronic complications are likely to occur, since the pelvic cavity commonly proves resistant to substances even more irritating than iodinated oil. The mucosa of normal fallopian tubes, removed ten days after an injection (to sterilize an epileptic patient), revealed no signs of irritation, appearing to be normal in every respect. The time of the disappearance of the iodinated oil apparently varies greatly in different individuals. In one patient, fourteen days after an injection, the x-ray plates failed to show any remaining solution. In another individual, sixty days after an injection, there still was a small amount present in the pelvis. Most likely this is the expression of an individual factor which in one leads to quicker absorption of iodinated oil than in another. The amount injected necessarily must play a part in this respect. The exact time of disappearance of the oil from the pelvis, I was not yet able to ascertain, but I am certain the absorption is relatively quickly accomplished, and is not a matter of months, as seems to be true of injections into the spinal canal.

Summarizing my personal experience to date, I can state that iodipin injections will prove of diagnostic value:

1. In sterility cases where the tubes are found obstructed, to determine the character and location of the obstruction. It offers the welcome opportunity to decide definitely whether or not the case is suitable for operation.

2. When several masses are palpable within the pelvis. Injection and x-ray study will clearly differentiate the uterus from the other masses.

3. In cases in which the pelvis is blocked by one large mass. By this method the precise diagnosis can be made whether the tumor is originating from ovary or uterus.

4. In cases in which a foreign body is suspected within or outside the uterine cavity.

5. Iodipin injections into the uterus prove helpful in differentiating chronic appendicitis from a right-sided salpingitis, and a tuberculous salpingitis from common salpingitis, which means that they possibly might enable us to make a definite diagnosis of a tuberculous tube.

6. It is a valuable aid in indicating the size of the uterus, and in determining whether the cavity is encroached upon by any masses such as a fibromyoma, a carcinoma of the fundus, etc.

7. Iodipin injections, carefully and skillfully done, are not likely to cause any harm.

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WALL BLDG.

### REPORT OF A CASE OF GENERAL EDEMA OF THE FETUS FROM A RENAL ECLAMPTIC MOTHER

BY BARNARD L. LIEBERMAN, B.S., M.B., M.D., DETROIT, MICH.

GENERAL edema of the fetus, congenital fetal dropsy, or hydrops neonatorum, although of uncommon occurrence, is nevertheless not a rare entity, the literature on the subject being fairly extensive; Fordyce<sup>1</sup> alone having collected 63 cases and Hohl<sup>2</sup> having 33 cases in his series. Ballantyne gives quite an extensive bibliography, whereas Capon<sup>3</sup> has described seven individual cases of this condition. It is rather from the etiologic standpoint that this condition assumes a rôle of interest and importance, very little being known as to the etiology and pathogenesis. Many interesting and diverse theories have been advanced, but no accurate explanation has as yet been forthcoming. Of the numerous theories advanced, that of a "maternal toxemia," as first stated by Ballantyne, has received the widest cognizance. It is for this reason that this case is presented and described, it being the offspring of a mother suffering from "eclampsia," which today is the outstanding "toxemia of pregnancy" and of which so little is known from the etiologic standpoint.

Ballantyne describes general edema of the fetus as: "A rare condition of the fetus, characterized by general anascarca, by the presence of fluid effusions in the peritoneal, pleural, and pericardial sacs, and usually by edema of the placenta: and resulting in the death of the fetus or infant before, during or very soon after birth. It is to



be distinguished from such conditions as ascites or peritonitis of the fetus, and fetal syphilis, edema neonatorum, and congenital elephantiasis." It is also to be differentiated from the condition known as hydrops sanguinolentus fetus.

Although the literature is extensive, there are only a few cases of true general fetal edema, and yet fewer cases associated with eclampsia in the mother.

Ballantyne<sup>4</sup> gives an extensive résumé of the history of this condition, stating that Hippocrates<sup>5</sup> described a case of "fleshy fetus" or "fetus carnosus." Bourgeois,<sup>6</sup> Plater,<sup>7</sup> Severin,<sup>8</sup> Seeger,<sup>9</sup> and Dorentius<sup>10</sup> described undoubted cases in the seventeenth century. Duttel,<sup>11</sup> De la Motte,<sup>12</sup> and Lospiehlerus<sup>13</sup> each described a case in the eighteenth century. During the last seventy-five years numerous additional cases have been reported.

The etiology of this condition is not known. The primary cause has been sought in disturbances of the mother, father, or fetus or placenta.

The maternal causes are those which are generally considered as the most likely. The case herein reported is presumed to be the result of a maternal toxemia, the mother having definitely given evidence of eclampsia. Schumann in a review of 30 cases found that there was distinct evidence of maternal toxemia, namely, edema, albuminuria, and vomiting. He assumed that maternal toxins had passed into the fetal circulation, producing results of a similar nature in the fetus. Doi, quoted by Capon,<sup>3</sup> states that in the blood of pregnant women suffering from the "kidney of pregnancy" and even more definitely in that of eclamptic patients, erythroblasts may be found, and that these disappear during the puerperium; inferring that a toxin which can stimulate the maternal blood-forming organs can stimulate those of the child also.

#### CASE REPORT

Mrs. E. M. (case of Dr. W. E. Welz, Detroit), age 41 years, para iii, American, housewife. Patient entered the hospital complaining of severe headache and edema of the lower extremities. History of being 32 weeks pregnant. Past history essentially negative. Menstrual history normal. First pregnancy, 48 hours labor, forceps delivery. Child living and well. Second pregnancy, 18 hours labor, normal delivery. Child living and well. Previous puerperia normal. Patient a fairly well developed, somewhat undernourished, white woman with no marked abnormal physical findings, with the exception of moderate edema of the ankles. Blood pressure on entrance, 200/140, Wassermann and Kahn test, negative.

The urine, sp. gr. 1.020, contained albumin, 2 plus, and hyaline casts.

Blood examination showed Hb. 58 per cent, R. B. C. 3,990,000, W. B. C. 8,850, P. N. 64 per cent, S. M. 32 per cent, and L. M. 4 per cent.

P. S. P. (Renal function) Test: in 1st hour, 30 per cent; 2nd hour, 15; total 45 per cent.

Ophthalmoscopy, slight increase in the diameter of the veins. Very slight papillœdema. No albuminuric white spots.

Capillary microscopy, increased tortuosity of the capillary loops. Many serpentine forms. Slight venous engorgement. Slight stasis.

Blood viscosity, 3.2, Hess method.

During the first day at the hospital the patient had five convulsions each averaging about 90 seconds. Venesection was performed twice for a total of 750 c.c. Morphine was given for sedative effect. The following day the blood pressure had dropped to 170/110. On the third day the patient went into labor and gave birth to a stillborn fetus to be described. Delivery was normal—spontaneous. Position L. O. A. Duration of labor, six and three-quarters hours. Puerperium normal.

The heart tones were heard until twenty-four hours preceding birth. The fetus was very slightly macerated, the maceration being more marked in the photograph.



Fig. 1.

due to the action of the preservative fluid. The edema was very marked in the right shoulder and arm and in the right abdomen, as is shown in the photograph. (Fig. 1.) This was due to the position of the fetus in the uterus, the fluid gravitating to the lowest level. The length was 42 cm. and weight, 1,920 grams.

The skin was white and glistening with several blebs on the trunk. The face had a slight purple tinge. The scalp tissues contained a slightly gelatinous amber colored fluid. The muscles were pale and edematous. The cranial contents showed some venous congestion. Cerebral tissues were glistening and edematous. A small amount of slightly turbid fluid was present. The pleural cavities were filled with a slightly opaque yellow fluid. Lungs pale pink in color; sank in water. The heart was normal. The peritoneal cavity was filled with slightly opaque yellow fluid. Abdominal viscera normal.

The placenta was found to have numerous large areas of red and white infarction with some evidence of edema. The cord was markedly edematous and had a lateral insertion.

## CONCLUSIONS

It cannot be stated definitely that there is any direct association between eclampsia and general fetal edema; in fact the two occur together rarely indeed. Wherever we do find the two states associated, however, we must consider the possibility of some third inter-linking factor being present, probably a toxic agent.

Schmidt and Monch<sup>14</sup> have suggested the existence of an inherited capillary narrowness, which is said to be a feature of infantilism in the mother and creates the possibility of the occurrence of eclampsia. Brugsch and Hinselmann have advocated a similar viewpoint from the standpoint of the occurrence of eclampsia in the mother.

We may assume that in the case here presented, the maternal toxins may have been the causative factors in the production of the general edema of the fetus.

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## REPORT OF A CASE OF CHORIOCARCINOMA OF THE UTERUS COMPLICATING PREGNANCY\*

By JOHN J. GILL, M.D., CHICAGO, ILL.

THIS case report is of interest on account of the patient's age, symptoms, and the pathology and condition of health one year after treatment.

Mrs. M. M., was born March 25, 1903. She was married at the age of eighteen, and has two healthy children; no miscarriages. Her past, personal, and family history have no bearing upon conditions now present.

Sept. 15, 1924, she was in good health, her weight was 135 pounds, her last regular menstruation occurred at that time. On December 15, the patient had a bloody vaginal discharge which recurred at frequent intervals during the sixty days following; on two occasions there was a profuse gush of blood. The other symptoms complained of at that time were, a thick mucous leucorrhea, severe pelvic pains, extreme loss of strength and weight, dyspnea, fainting spells, and blurred vision. On February 15, 1925, she entered Wesley Memorial Hospital; her weight was 98 pounds, red cell count, 3,600,000; white cells, 8900, hemaglobin 75 per cent, urine negative except for some pus cells, temperature 100° F., abdomen very tender but not distended. On February 16, I performed an exploratory laparotomy, removed a chronically inflamed fibrinous appendix. The large, soft, boggy uterus, completely studded over with tubercles varying from pinhead to pea-sized which did not penetrate the peritoneum, was sufficient evidence to warrant a hysterectomy.

The uterine body with a five months' fetus and other contents, removed intact, was examined by Dr. H. R. Fishback. His report showed the soft infiltrating nodules which permeated the uterine musculature to be choriocarcinoma.

Deep roentgen-ray therapy was administered by Dr. S. J. Alden, and the patient, very greatly improved in health, returned to her home on March 21, 1925. One year after her operation, she weighed 150 pounds, worked hard and stated that she felt stronger and better than ever.

\*The patient and specimens were exhibited at a staff meeting at Wesley Memorial Hospital, Feb. 5, 1926.

Physical examination showed no evidence of recurrence.

*Pathological Report.* (By H. F. Fishback, M.D., Wesley Memorial Hospital Laboratory, Chicago).—The specimen consists of the entire body of the uterus

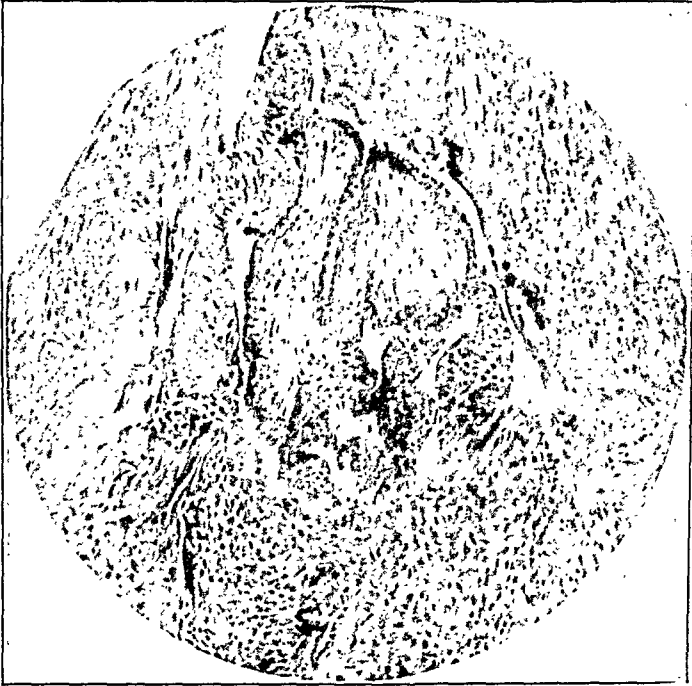


Fig. 1.—Infiltration of myometrium by tumor cells.



Fig. 2.—Tumor cells bound within a blood sinus.

which has been opened by a vertical cut in the anterior wall. It is symmetrically enlarged, 9x6x14 cm. and is boggy. Blood vessels are dilated and congested. There are several small yellowish, dark-red spots beneath the serosa of the upper half

of the uterus, which are fairly sharply demarcated, not elevated, and measure from 1 to 3 mm. in size. They are rather soft to the touch and upon section appear red and have in them considerable blood.

The inner surface of the uterus exhibits a thickened, soft endometrium over its lower half. The fundus portion is raw and bloody, and small bits of torn tissue project raggedly from its surface.

Sections through the wall show a heavy, soft, red muscularis containing considerable blood in widened blood channels. In the lower portion of the uterine body, the thickened endometrium can be stripped off, leaving a smooth surface. The torn fragments of the fundus are firmly attached and show extension as soft reddish-yellow bands in the myometrium. Areas of similar appearance are found irregularly throughout the wall of the fundus, but no extension outside of the uterus is found.



Fig. 3.—Chorionic villus showing extension of Langhans cells into solid tissue of uterine wall.

*Histologic Examination.*—Microscopic sections of the fundus show a rough, torn inner surface. This free surface has many projecting bundles of smooth muscle fibers mingled with irregular patches of epithelial cells of Langhans' group. There is some hemorrhage on the free margin, and wide, open blood sinuses are found running to the surface.

Two chorionic villi with normal-appearing cores are found. There is no evidence of cystic degeneration as in placental moles. At the margin of these villi are found masses of Langhans' cells shown to continue as infiltrating masses in the myometrium. No covering growth of syncytium is present about the Langhans' cell masses, although there are a few irregular, small multinuclear masses of syncytium with acidophile cytoplasm in the muscle.

The muscle is extensively infiltrated by cords and nests of Langhans' cells extending directly out into the wall, with destruction of infiltrated muscle fibers. There is no growth of tumor cells apparent along the blood channels; although there is an occasional small, loose collection of epithelial cells found within a blood sinus near the surface, it is possible that these are the cut off tips of chorionic villi.

A diagnosis of malignant tumor is established by the type of infiltration and destruction of muscle by cords and nests of atypical epithelial cells derived from Langhans' cells of the villi. Syncytial masses are few and small, and there are no inflammatory cells present, so that syncytioma need not be considered.

The placental structure which was removed was not available for examination. Chorionic villi are shown, however, with no evidence of hydatidiform degeneration.

The few villi present have cores of normal structure which indicates probably a lesser degree of malignancy, but, I believe, does not disprove a diagnosis of choriocarcinoma.

5708 HARPER AVENUE.

## A STUDY OF THE BASAL METABOLISM, WEIGHT, AND BLOOD CHEMISTRY FOLLOWING BILATERAL OOPHORECTOMY\*

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THERE is at the present time very little known concerning the physiology of the ovary except in its relation to the generative function. Comparatively few studies have been undertaken to determine the effect on the general metabolism after bilateral oophorectomy and most of these investigations have been carried out on animals.

Loewy and Richter<sup>1</sup> investigated the metabolic rate and stated that a definite reduction in the metabolism took place from three weeks to three and one-half months after castration. This reduction from the normal was about 12 per cent. Feeding oophorin resulted in an increase of more than 50 per cent in the metabolic rate of the castrates. It has been shown by Frank<sup>2</sup>, Geist and Harris<sup>3</sup>, and others that the various commercial extracts are physiologically inactive. Administration of these preparations fails to prevent the castration atrophy and one must be most careful in concluding that changes following the exhibition of these substances are due to their administration.

Leuethje<sup>4</sup> studied the effects on metabolism in castrated dogs and concluded that the gonads have no specific influence. He offered the suggestion that the gain in weight in women at the menopause might be due to a change in their habits. He found no definite change of any kind following castration.

Curatula and Tarueli<sup>5</sup> found a gain in weight and diminution in metabolism in a series of experiments carried out on a dog and several rats. A diminution of phosphorus excretion was also found, which is opposed to the findings of Bell<sup>6</sup> who reported an increase of phosphorus excretion in castrated animals.

McCrudden<sup>7</sup> studying the metabolism in animals after castration found no general retention of the mineral elements. He also found that castration does not cause a decrease in oxidation. He pointed out that most of the experiments by other authors on the metabolism of mineral elements were not properly controlled.

\*Read at a meeting of the New York Obstetrical Society, March 2, 1926.

Aub<sup>8</sup> states that the gonads are a factor in influencing the rate of metabolism but that this role is a minor one. The removal of the gonads is followed by a slight fall in the metabolic rate.

Murlin and Bailey<sup>9</sup> carried out a series of careful experiments on two castrated dogs. They found the metabolism reduced in both animals. One, however, had had a previous thyroidectomy. Both animals gained in weight. This weight gain might have been accounted for by a lessening of muscular activity or by dietary excesses greater than their postoperative needs. The animal on whom a previous thyroidectomy had been performed, showed a less marked diminution of metabolism than the other.

Zunst<sup>10</sup> carried out a series of experiments on four women operatively castrated, who were menstruating up to the time of operation, i.e., they had functioning ovaries. Two of these women showed a diminution of metabolism seven weeks after operation. The reduction was very slight and might be considered within the limits of technical error. The other two women had fever, pain, and were ill at the time of the determinations, which factors may have influenced the results. These women showed no gain in weight. He then fed them oophorin but found no increase in the metabolic rate.

Biedl<sup>11</sup> states that the administration of ovarian extract will raise the lowered metabolism in castrated animals as much as 30 to 50 per cent above the standard obtained before operation. These results were not his own but are quotations from the literature and are made doubtful by our previously mentioned results.<sup>3</sup>

Plaut<sup>12</sup> studied five women sterilized by radiation and thus rendered amenorrheic. He investigated the basal metabolism and found a marked depression. This lowered basal metabolic rate gradually returned to normal. This latter condition he believes is due to a compensatory increased thyroid activity.

Kraul and Halter<sup>13</sup> studied five cases of x-ray castration and found a diminution of 20 per cent in the basal metabolism. They also found a weight increase at the end of three months.

Korenchevsky<sup>14</sup> found that both nitrogenous and, in most cases, gaseous metabolism were decreased after castration in fat-castrated dogs. In thin-castrated dogs the diminution was usually less pronounced or absent. The gaseous metabolism was sometimes considerably increased. He suggests the presence of specific gonadal hormones which influence body metabolism. This influence may be direct or due to secondary changes in the thyroid, hypophysis, adrenals and pancreas.

Hegar<sup>15</sup> and Keppler<sup>16</sup> studied a series of castrated women over a long period of time and found no weight increase, contrary to the generally accepted belief.

Bugbee and Simond<sup>18</sup> studied the metabolism of a castrated male dog and failed to show that castration in itself reduces the basal metabolic rate.

It will be noted that the results of the various investigations are somewhat at variance.

We attempted to study the effects of castration on the basal metabolism, weight, and blood chemistry, in order to determine if in human females living under normal conditions the removal of the gonads exerts any definable effect, also to ascertain, if possible, whether the removal of the ovaries is followed by results of sufficient physiologic importance to make it advisable to conserve them when technically possible.

We studied a total of forty-eight cases. In all of the women the menstrual function was still active before operation, so that we felt warranted to conclude that these patients were possessed of func-



tionating ovaries. In no case, as far as we could determine, was there any evidence of disease or disturbance of any other glands of internal secretion. The ovaries in some instances were microcystic.

In seven cases used as controls, three upon whom extensive vaginal plastic operations had been performed, had both ovaries conserved, the other four had one ovary left in situ.

The patients were weighed immediately before operation, after fasting eighteen hours. In addition 15 c.c. of blood was taken from the median basilic vein at this time for chemical analysis, and then the basal metabolism was determined. The process was repeated two weeks after operation and again three to five months later. Table

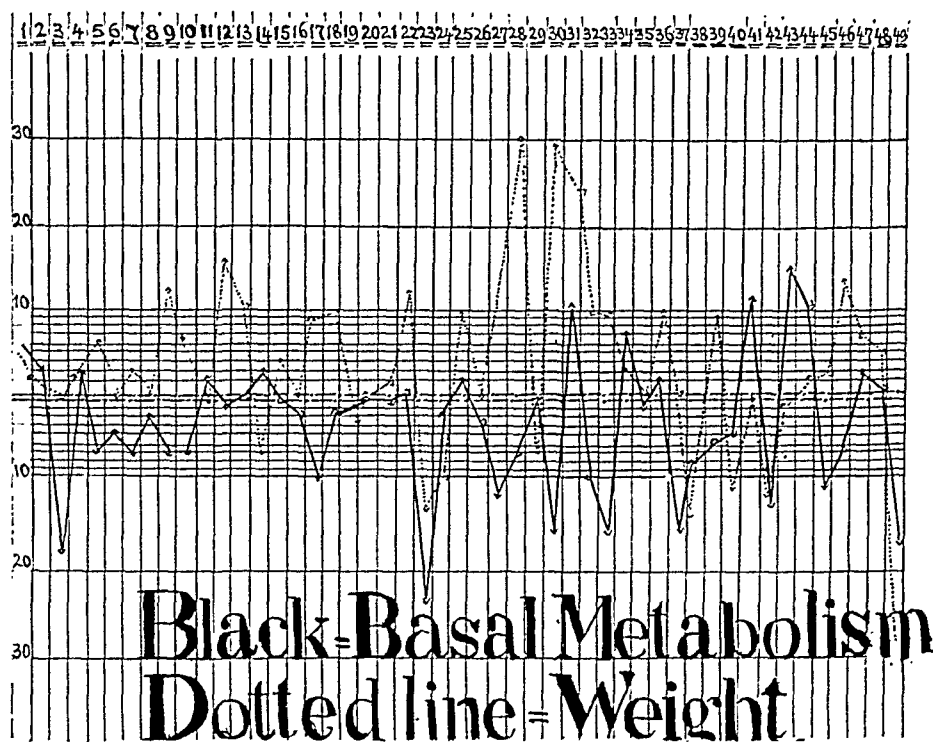


Fig. 1.—Illustrates individual cases with the basal metabolism and weight variation. The numbers at the head of the chart represent the case numbers. The double base line represents the preoperative figure, the position above the line an increase either in weight or metabolism or both, the position below the line a diminution. The tendency for a diminution in basal metabolism and increase in body weight can be noted and the relation between weight and basal metabolism can be compared in individual cases.

It represents the weight variations up to three months after operation. We realize that the period of observation is short. Nevertheless, the tendency for weight change can be determined. It is our intention to confirm these observations on as many patients as is possible.

Several of these cases need a word of explanation. Cases 2, 3, 5 and 45 weighed over 200 lbs. before operation. These women with but one exception showed no definite cause to account for their obesity. Case 5 presented a moderate hypertrichiasis. She had a small submucous fibroid. Case 45 had a slight diminution in basal

TABLE I

	PREOP. WT.	POST. WT.	3 MONS. P. O.	DIFFERENCE
1.	145	145	140	- 5
2.	212		210	- 2
3.	260		260	0
4.	161	154	160	- 1
5.	234	242	240	+ 6
6.	150	150	150	0
7.	158	160	160	+ 2
8.	137	137	137	0
9.	115	115	127	+ 12
10.	112		117	+ 5
11.	130		129	- 1
12.	175	185	190	+ 15
13.	105	110	115	+ 10
14.	99½	99	92	- 7½
15.	180	185	185	+ 5
16.	160	160	160	0
17.	170	175	175	+ 5
18.	140	148	148	+ 8
19.	116½		104½	- 12
20.	154	152½	153	- 1
21.	108	106	108¾	+ ¾
22.	130		144	+ 14
23.	145		128½	- 16½
24.	180		168	- 12
25.	153	141	161½	+ 8½
26.	157½	145	155½	- 2
27.	157½	not done	166	+ 8½
28.	166½	not done	186	+ 19½
29.	109¼	99¼	102½	- 6¾
30.	150	143½	175¾	+ 25¾
31.	185	169¼	207	+ 22
32.	132½	125½	140	+ 7½
33.	129	117	136	+ 7
34.	160	144	164	+ 4
35.	148½	138½	148½	0
36.	156	not done	168	+ 12
37.	108	not done	108	0
38.	152	145	136	- 16
39.	153½	144	162	+ 8½
40.	155	142	142	- 13
41.	185	not done	185	0
42.	163¾	150	150	- 13¾
43.	131	not done	130	- 1
44.	99	97	102	+ 3
45.	216	209¼	222	+ 6
46.	135½	125¼	150	+ 14½
47.	170	168	176	+ 6
48.	106	105	110	+ 4

## CONTROL CASES

A	150	150	150	0
B	97	97	103	+ 6
C	168	165	165	- 3
D	148¾	145	148	- ¾
E	124	114	114	- 10
F	123¼	116	130	+ 6¾
G	133¾	132½	137	+ 3¼

## SUMMARY OF TABLE I

	WEIGHT GAIN	WEIGHT LOSS	NO CHANGE
Cases	26	15	7
Controls	3	3	1

metabolism (preoperative) but within normal limits. Four cases showed excessive weight changes, Cases 23, 28, 30 and 31. Case 23 showed a marked diminution in basal metabolism but a loss of  $16\frac{1}{2}$  pounds in weight, and Case 30 showed a marked increase in weight and a decrease in metabolism. The others presented no unusual condition to account for the weight change.

Faber<sup>17</sup> states that the tendency to accumulate fat increases as the endocrine system grows less active with advancing years. This is especially manifest in women at the menopause, although the basal metabolism is normal. If the caloric intake is above the physiologic requirement the superfluous calories throw an extra task on the organs which regulate oxidation and radiation of heat. If these organs are unequal to the task the superfluous nourishment is deposited as glycogen and fat. This metabolic anomaly may not affect the basal metabolism. This, as will be seen later, may explain why a weight increase need not necessarily signify a decrease in basal metabolism or vice versa as in Case 23.

Weight studies on patients who have returned to their homes are not entirely reliable, as many factors that influence weight, cannot be controlled after the patient has left the hospital. The physical activity (muscular), the food intake, and the psychic tranquillity have an important bearing. However, the general environment of these patients was apparently the same before as well as after operation. If any tendency exists it should manifest itself in a large series of cases and our study would indicate a tendency to weight increase. The belief, however, that castration in women is always followed by a weight increase must be modified.

In Table II we have arranged the results of the basal metabolism tests as preoperative, two weeks postoperative, and three months postoperative. The variations have been designated as minus or plus. This variation is calculated from the preoperative basal metabolism as compared with the last or three months postoperative basal metabolism.

The basal metabolism tests were conducted by Dr. Lande and the method used was as follows:

The Sanborn-Benedict apparatus was used in the determination of the basal metabolism rate, oxygen consumption alone being determined. The patients were in the absorptive state, that is about 14 hours after the last food intake, and thoroughly rested before the tests were made. Surface area was calculated according to the Aub-Dubois height-weight formula, and the normal standards of these same authors were used. In presenting these cases we wish to emphasize the necessity of great caution in interpreting basal metabolism variations. Appreciable variations in daily observations on basal metabolism are not infrequently encountered both in normal and pathologic individuals. In normal individuals the variations may amount to 10 per cent. We also wish to point out that basal metabolism determinations may be considered accurate when check observations vary less than 5 per cent.

TABLE II

	PREOP.	2 WEEKS POSTOP.	AFTER 3 MOS.	VARIATIONS
1.	35 - 3%	35 - 3%	38 + 3%	+ 6%
2.	38.6 + 8%	37 + 2	39.6 + 10%	+ 2%
3.	38 + 6%	34.5 - 5%	32 - 11%	-17%
4.	36 normal	34.5 - 5%	37.8 + 3%	+ 3%
5.	39.5 + 8%	36 normal	35.8 normal	- 8%
6.	34.7 - 3%	37 + 3%	32.8 - 9%	- 6%
7.	40 + 8%	36.8	36.8 normal	- 8%
8.	39 + 8%	38.5 + 5%	38.5 + 5%	- 3%
9.	39 + 8%	37.5 + 4%	36 normal	- 8%
10.	39 + 10%	37 + 4%	36 + 2%	- 8%
11.	36 normal	36 normal	37 + 2%	+ 2%
12.	38 + 3%	36 normal	36 normal	- 3%
13.	36 normal	36 normal	36 normal	0%
14.	35.5 normal	35.5 normal	37 + 4%	+ 4%
15.	36.5 normal	40 + 5%	36.5 normal	0
16.	37.5 + 2%	35.6 - 5%	37 normal	- 2%
17.	41 + 14%	37 normal	35 - 3%	-17%
18.	38 + 4%	36½ normal	36.5 normal	- 4%
19.	40 + 7%	- -	38 + 5%	- 2%
20.	38.2 + 4%	38 + 4%	37.5 + 3%	- 1%
21.	36 normal	36 normal	36.5 normal	0
22.*	-	-	-	-
23.	44.8 + 24%	-	36 normal	-24%
24.	36.5 normal	-	35 - 3%	- 3%
25.	37.2 + 3%	37.5 + 4%	37.8 + 5%	+ 2%
26.	36 normal	35.4 - 2%	34.4 - 4%	- 4%
27.	39.6 + 10%	Not done	35.2 - 2%	-12%
28.	36 normal	Not done	34 - 7%	- 7%
29.	36 normal	36.7 normal	36 normal	0
30.	41 + 11%	40.8 + 11%	34.7 - 5%	-16%
31.	34 - 6%	Not done	37.7 + 5%	+11%
32.	37.5 + 4%	36.2 normal	31 - 14%	-10%
33.	38 + 5%	40 + 9%	31.8 - 12%	-17%
34.	34 - 7%	40 + 9%	35.8 - 2%	+ 5%
35.	36 normal	35.3 - 2%	35.3 - 2%	- 2%
36.	36.9 + 2%	32 - 11%	37.6 + 4%	+ 2%
37.	41 + 8%	36 - 4%	34 - 9%	-17%
38.	43.3 + 8%	32.5 - 9%	37 normal	- 8%
39.	33.8 - 6%	32 - 11%	32 - 11%	- 5%
40.	34.4 - 5%	36.9 + 2%	33 - 9%	- 4%
41.	34 - 6%	35.2 - 2%	37.3 + 5%	+11%
42.	38.8 + 9%	35 normal	33.5 - 4%	-13%
43.	27 - 25%	30.8 - 18%	33.2 - 9%	+16%
44.	35.5 normal	39 + 8%	40 + 11%	+11%
45.	33.2 - 9%	32 - 12%	28 - 20%	-11%
46.	37 normal	33 - 9%	34 - 7%	- 7%
47.	36.6 + 2%	28 - 20%	38 + 5%	+ 3%
48.	32 - 10%	35.2 - 2%	32 - 11%	- 1%

\*Case 22 included because of other studies on weight and blood chemistry.

## CONTROL CASES

	PREOP.	POSTOP.	AFTER 3 MOS.	VARIATIONS
A)	38 + 6%	34 + 5%	34.6 - 4%	-10%
B)	37 normal	39 + 5%	35.7 - 2%	- 2%
C)	35 - 2%	36 normal	38.4 + 6%	+ 8%
D)	38 + 5%		38 + 4%	- 1%
E)	42 + 15%	39 + 10%	30.5 - 9%	-24%
F)	35.5 - 2%	36.6 normal	33.5 - 9%	- 7%
G)	36 normal		36 normal	0

## SUMMARY OF TABLE II

	B.M. GAIN	B.M. LOSS	B.M. UNCHANGED
Cases	13	31	4
Controls	1	5	1

## CONCLUSIONS FROM TABLE II

Thirty-one cases in this series showed a decrease from 1 to 24 per cent.

Thirteen of the cases showed an increase ranging from 2 to 15 per cent.

TABLE III

	VARIATION IN BASAL METABOLISM	DIFFERENCE IN WEIGHT		VARIATION IN BASAL METABOLISM	DIFFERENCE IN WEIGHT
1.	+ 6%	- 5 lbs.	25.	+ 2%	+ 8½ lbs.
2.	+ 2%	- 2 "	26.	- 4%	- 2 "
3.	-17%	0 "	27.	-12%	+ 8½ "
4.	+ 3%	- 1 "	28.	- 7%	+19½ "
5.	- 8%	+ 6 "	29.	0	- 6¾ "
6.	- 6%	0 "	30.	-16%	+25¾ "
7.	- 8%	+ 2 "	31.	+11%	+22 "
8.	- 3%	0 "	32.	-10%	+ 7½ "
9.	- 8%	+12 "	33.	-17%	+ 7 "
10.	- 8%	+ 5 "	34.	+ 5%	+ 4 "
11.	+ 2%	- 1 "	35.	- 2%	0 "
12.	- 3%	+15 "	36.	+ 2%	+12 "
13.	0%	+10 "	37.	-17%	0 "
14.	+ 4%	- 7½ "	38.	- 8%	-16 "
15.	0%	+ 5 "	39.	- 5%	+ 8½ "
16.	- 2%	0 "	40.	- 4%	-13 "
17.	-17	+ 5 "	41.	+11%	0 "
18.	- 4%	+ 8 "	42.	-13%	-13¾ "
19.	- 2%	-12 "	43.	+16%	- 1 "
20.	- 1%	- 1 "	44.	+11%	+ 3 "
21.	0%	+ ¾ "	45.	-11%	+ 6 "
22.	—	+14 "	46.	- 7%	+14½ "
23.	-24%	-16½ "	47.	+ 3%	+ 6 "
24.	- 3%	-12 "	48.	- 1%	+ 4 "

## CONTROL CASES

	VARIATION IN BASAL METABOLISM	DIFFERENCE IN WEIGHT
A)	-10%	0 lbs.
B)	- 2%	+ 6 "
C)	+ 8%	- 3 "
D)	- 1%	- ¾ "
E)	-11%	-10 "
F)	- 7%	+ 6¾ "
G)	0	+ 3½ "

## SUMMARY OF TABLE III

13 cases with Basal Metabolism —	{ Weight loss — 6 cases
Rate gain showed —	{ Weight unchanged — 1 case
	{ Weight gain — 6 cases
30 cases with Basal Metabolism —	{ Weight loss — 8 cases
Rate loss showed —	{ Weight unchanged — 6 cases
	{ Weight gain — 16 cases
4 cases with Basal Metabolism —	{ Weight increase — 3 cases
Rate unchanged showed —	{ Weight decrease — 1 case

## CONTROL CASES

1 Case with Basal Metabolism—rate gain showed—Weight decrease—1 case.	
5 Cases with Basal Metabolism—	{ Weight gain —2 cases
Rate loss showed	{ Weight unchanged—1 case
	{ Weight loss —2 cases
1 Case with Basal Metabolism—rate unchanged showed—Weight increase—1 case	

In four cases there was no change and in one the readings were missing so that a variation could not be determined.

It is well to bear in mind that the postoperative rest in bed and the following period of restricted activity would both tend to a lowered basal metabolic rate. It would be well not to conclude that the general tendency toward a reduced basal metabolism rate after castration is due entirely to the removal of the gonads. In several instances where the difference between preoperative and postoperative readings showed a marked reduction as in Cases 3, 17, 27 and 37 the individual readings were within normal limits and the difference might permit of another interpretation.

However, the fact remains that in the majority of cases studied the tendency has been for a diminution, even though 20 of the 31 cases were within the limit of technical error. It is rather significant that this technical error tended always below the normal.

It is interesting to note that there is no definite relation between the weight gain and the basal metabolism rate. In the case with the greatest diminution in basal metabolism rate of +17 per cent no weight change was noted. (Table III.)

We would not expect these relationships though Faber has offered an explanation for this discrepancy. We feel, as mentioned before, that factors other than the metabolic rate must be important in controlling the weight.

In 16 of the 48 cases,  $33\frac{1}{3}$  per cent, there was a decrease in basal metabolism and increase in weight. These range from a basal metabolism rate loss of 1 per cent and a  $\frac{1}{2}$  pounds gain to a 16 per cent basal metabolism rate decrease and a  $25\frac{3}{4}$  pounds gain. There does not seem to be any arithmetical relation between the decreased basal metabolism rate and the increase of weight, e.g., Case 28 with a basal metabolism rate loss of 7 per cent had a  $25\frac{1}{2}$  pounds weight increase, and Case 27 with a basal metabolism rate loss of 12 per cent only had an 8 pounds increase. In six cases in which there was a basal metabolism rate diminution the weight was stationary.

Lack of conformity between basal metabolism and weight variation is not an unusual finding in metabolic studies of any kind. The great majority of obesity cases have a normal metabolic rate, and it is only in rare instances that weight increase can be explained solely on the basis of a decreased basal metabolism.

In Table IV we have tabulated the results of the blood chemistry studies. It will be seen that there are no significant variations and we are compelled to conclude that the removal of the ovaries results in no change in the blood chemistry, as determined up to a period three months postoperative, with our present method of investigation.

In Table V we have a record of pre- and postoperative blood pressure readings. These readings were taken twenty-four hours pre-

TABLE IV

Case	UREA N.				INCOAG. N.				URIC ACID				CREATININ				CHOLESTERIN			
	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.
1	16.8	19.6	14.0	-2.8	63.0	40.9	30.7	-32.3	5.0		1.6	-3.4	0.7	1.0	+0.3	0.188	0.144	0.144	-0.044	
2	18.2	19.6	18.2	0	50.2	42.0	35.0	-15.2	3.2	1.9	2.6	-0.6	1.5	1.2	-0.2	QNS	0.182	0.126		
3	21.0	23.8	11.2	-9.8	54.3	54.6	35.0	-19.3	2.2	1.8	2.0	-0.2	1.2	1.0	+0.2	0.206	0.300	0.218	+0.012	
4	14.0	12.6	15.4	+1.4	34.1	31.2	42.0	+7.9	4.8	2.0	2.17	-2.63	1.1	1.3	+0.1	QNS	QNS	0.19		
5	23.8	15.6	16.8	-7.0	31.5	34.1	38.5	+7.0	3.18	2.5	3.13	-0.05	1.3	1.0	-0.3	0.172	0.166	0.142	-0.030	
6	23.8	22.4	22.4		34.1	46.5	38.5	+4.4	5.2	2.8	2.0	-3.2	1.2	1.3	-0.2	0.254	QNS	0.206	-0.048	
7	16.8	14.0	12.6	-4.2	30.9	30.7	43.3	+12.4	2.5	1.8	2.1	-0.4	1.0	1.1	0	0.150	0.150	0.170	+0.020	
8	18.2	15.4	16.8	-1.4	40.0	50.9	46.7	+6.7	2.6	3.2	3.0	+0.4	1.0	1.0	+0.3	QNS	QNS	0.160		
9	22.4	11.2	21.0	-1.4	49.0	38.5	47.8	-1.2	2.9	1.5	1.7	-1.2	0.9	1.0	0	0.181	QNS	0.230	+0.049	
10	14.0	16.8	15.4	+1.4	35.9	52.5	35.0	-0.9	1.5	1.5	2.0	+0.5	0.9	1.4	+0.5	QNS	0.132	QNS		
11	21.0	12.6	12.9	-8.1	40.9	30.0	37.8	-3.1	1.4	2.0	2.1	+0.7	1.4	1.0	-0.1	0.230	QNS	QNS		
12	25.2	16.8	15.4	-9.8	36.7	43.3	45.5	+8.8	1.9	1.3	2.3	+0.4	1.4	0.9	-0.3	0.114	QNS	QNS		
13	14.0	11.2	14.0	0	37.6	40.9	33.3	-4.3	1.5	1.3	1.7	+0.22	1.0	0.9	0	0.114	QNS	0.160	+0.046	
14	21.0	15.2			23.3	30.9			1.7	1.5			1.3	0.9		0.170	QNS	0.150	-0.020	
15		12.6	18.2			32.3	37.6			2.4	4.2			1.6	1.3		0.160	0.290		
16		14.0	14.0			30.7	36.7			1.9	2.1			0.9	1.0		0.100			
17			15.4				35.0				2.1				0.8		0.124			
18			12.6				31.5				3.8				1.3		0.142			
19	18.0		16.8	-1.2	40.0		QNS		2.5		2.0	-0.5	1.1		1.8	QNS	QNS	0.190		
20		16.8	14.0			QNS	31.5				1.8			0.4	1.0	QNS	QNS	0.136		
21		18.2				45.5	27.3			1.7	1.6			1.2	1.0	QNS	QNS	0.130		
22	14.0		15.4	+1.4	31.5		42.0	+10.5	4.2		2.5	-1.7	1.0		1.4	QNS	QNS	0.130	-0.020	
23	QNS		16.8		35.0		35.0	-0	3.7		2.5	-1.2	1.1		1.4	0.188	QNS	QNS	-0.001	
24	12.6		18.2	+5.6	30.0		42.0	+12.0	2.7		1.8	-0.9	1.4	1.0	-0.4	0.150	QNS	QNS	+0.01	
25	14.0	12.6	14.0	0	34.1		30.0	-4.1	2.5	2.1	3.9	+1.4	0.9	1.0	+0.2	0.16	0.212	0.170	+0.07	
26	14.0	14.0	12.6	-1.4	33.4	40.9	26.7	-6.7	2.4	2.1	4.3	+1.9	1.1	1.1	+0.1	0.124	0.160	0.194	+0.07	
27	11.2		14.0	+2.8	30.0		43.3	+13.3	2.5		2.0	-0.5	1.0		1.1	0.236	0.206	0.206	-0.03	

\*QNS=Quantity not sufficient for examination.

TABLE IV—CONTINUED

Case	UREA N.				INCOAG. N.				URIC ACID				CREATININ				CHOLESTERIN			
	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.
28	12.6	12.6	12.6	0	35.9		30.7	-5.2	1.6		2.3	+0.7	1.0		1.1	+0.1	0.100		0.170	+0.07
29	14.0	23.8	21.0	+7.0	30.0		51.2	+21.2	2.4		3.8	+1.4	1.1		1.0	-0.1	0.226	0.146	0.294	+0.008
30	18.2	14.0	15.4	-2.8	30.0		32.6	+2.6	1.8	2.0	2.3	+0.5	1.0	1.0	0.9	-0.1	0.130	0.148	0.178	+0.048
31	15.4		16.0	+0.6	30.0		30.0	0	2.3		2.0	-0.3	1.2		1.1	-0.1	0.236		0.16	-0.076
32	12.6	14.0	15.4	+2.8	34.1		QNS		1.7	1.6	2.1	+0.4	0.9	1.0	1.0	+0.1	0.112	0.180	0.178	+0.066
33	12.6	14.0	14.0	+1.4	30.0		35.8	+5.8	1.5	2.5	1.8	+0.3	1.1	1.0	1.0	-0.1	0.225	0.182	0.170	-0.055
34	14.0		18.2	+4.2	36.1		33.3	-2.8	2.1		2.0	-0.1	1.1		1.1	0	0.120		0.176	+0.056
35	14.0	14.0	19.6	+5.6	QNS		QNS		1.6	2.0	2.3	+0.7	1.0	1.1	1.0	0	0.130	0.184	0.190	+0.060
36	12.6	11.2	16.8	+4.2	27.3		34.1	+6.8	1.8	1.8	2.3	+0.5	0.8	0.9	1.0	+0.2	0.124	0.136	0.142	+0.018
37	11.2	12.6	16.8	+5.6	37.6		35.0	-2.6	1.8	1.8	1.8	0	0.9	0.9	1.0	+0.1	0.206	0.130	0.188	-0.18
38	16.8	16.2	14.0	-2.8	29.3		37.6		1.6	3.1	2.3	+0.7	0.9	1.2	1.1	+0.2	0.188	0.164	0.142	-0.068
39	12.6	15.4	14.0	+1.4	33.3		38.5		2.1	3.0	2.5	+0.4	1.0	1.0	1.1	+0.1	0.170	0.147	0.118	-0.052
40	14.0		14.0	0	36.7		33.3	-3.4	2.0	0	1.8	-0.2	1.1		1.0	-0.1	0.130		0.170	+0.040
41	15.4		14.0	-1.4	30.0		30.0	0	2.3	0	3.0	+0.7	1.2		1.0	-0.2	0.236		0.160	-0.076
42	14.0	12.6	22.4	+8.4	33.3		48.8	+15.5	1.9	QNS	1.9	0	1.1	1.0	1.0	-0.1	0.194	0.160	0.188	-0.060
43	18.2	15.4	21.0	+2.8	35.0		38.6	+3.6	1.7	2.0	1.5	-0.2	1.1	1.0	1.1	0	0.100	0.124	0.176	+0.016
44	14.0	14.0	16.8	+2.8	30.0		QNS	+12.3	2.0	2.0	2.0	0	1.2	1.0	1.1	-0.1	0.100	0.182	0.212	+0.112
45	14.0	15.4	18.2	+4.2	30.0		42.3	+12.3	2.0	2.0	3.8	+1.5	1.1	1.0	1.2	+0.1	0.218	0.170	0.170	-0.048
46	15.4	14.0	14.0	-1.4	QNS		33.3		3.5	2.3	3.5	0	1.1	1.0	1.1	0	0.170	0.218	0.200	+0.030
47	14.0	14.0	14.0	0	33.3		33.3	0	2.1	2.5	3.0	+0.9	1.0	1.1	1.0	0	0.117	0.236	0.176	+0.059
48	15.4	15.4	19.6	+4.2	36.7		36.7	0	1.8	1.8	2.5	+0.7	0.9	0.9	1.0	+0.1	0.136	0.118	0.176	+0.040

CONTROL CASES									
Case	1st	2nd	3rd	Diff.	1st	2nd	3rd	Diff.	1st
A	23.8	16.0	16.8		47.8	32.3	30.7	-17.1	QNS
B	15.4	15.4	14.0		35.9	43.3	30.0	-5.9	1.1
C	11.2	12.6	16.4		36.7	40.0	36.7	0	1.0
D	14.0	14.9	14.0		30.0	30.0	30.8	+0.8	1.0
E	22.4	15.4	21.0		31.5	31.5	44.4	+12.9	1.2
F	19.6	12.6	19.6	0	39.5	QNS	40.2	+0.7	1.1



operative, some two weeks postoperative and all again three months postoperative. Here again we found no change of significant nature and must conclude that the operative removal of the ovaries does not cause any definite change in blood pressure up to a period three months postoperative.

TABLE V  
BLOOD PRESSURE

CASE	1ST	2ND	3RD	DIFF.
25	120/80		116/96	
26	158/72		104/76	
27	125/90		112/72	
28	92/60		128/90	
29	116/78	105/60	122/108	
30	110/78	120/80	110/74	
31	118/75		120/80	
32	125/80	122/78	125/80	
33	118/68	115/60	140/90	
34	115/80	138/78	110/72	
35	105/78	90/60	110/78	
36	128/75	95/50	95/65	
37	85/60		130/80	
38	170/110	135/86	155/85	
39	120/80		120/82	
40	110/70	110/75	110/70	
41	118/75		118/70	
42	125/78	125/78	120/70	
44	105/65	110/70	110/78	
45	100/60	146/96	120/80	
46	105/60		120/80	
47	120/100	106/40	130/86	
48	120/100		98/60	

Summing up the results of our investigations it would seem that castration in women with previously functioning ovaries does not result in a consistent variation of the basal metabolism or the body weight. There seems to be no definite relationship between the variations in weight and basal metabolism. Likewise the blood chemistry and pressure remain uninfluenced.

These results may be due to (a) the inaccuracy of our present clinical methods of examination, (b) the influence of other important extraneous factors, (c) the absence of any ovarian influence.

The changes above mentioned are not of sufficient fundamental importance to warrant their being used as an argument for the conservation of the ovaries.

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(For discussion, see page 288.)

## PROBLEMS OF ORGAN CONSERVATION IN PELVIC SURGERY\*

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IN THE daily routine of pelvic surgery the gynecologist is repeatedly confronted with questions of organ conservation, the decision of which may have a most important bearing on the later welfare of the patient. The solution of these numerous problems not only involves the physical health of the patient but it must take into serious account also her mental equanimity and her domestic relationships. In certain cases in which the life of the patient is at stake the problems are simple and depend upon an ordinary knowledge of pelvic pathology. In other cases, however, in which the health of the patient is less seriously involved the problems are more complex and demand for their wise solution an understanding not only of woman in general but of the particular womanhood of the patient under treatment. Before taking up in detail the questions of operative technic in organ conservation and removal, I will, with your permission, devote the first part of this paper to a discussion of womankind in her specific relationship to her genital apparatus. The subject will be approached from two angles: first, that of the actual physical value of the genital organs to the female organism, and secondly, woman's personal valuation of her sexual apparatus.

*Physical Value of the Genital Organs.*—Our first inquiry, then, is: What is the distinctive importance of the female genital organs, severally and collectively, to the life and well-being of the individual? This seemingly axiomatic question would not by any means be uniformly answered either by the profession or the laity, and it therefore deserves a brief discussion.

During the period of childhood, that is to say, from infancy to puberty, the ovaries are the dominant factors in the genital system, for they undoubtedly play an important rôle in somatic development,

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the other organs being of passive significance. Every gynecologist has seen examples of full bodily development, even including secondary sexual characters in women with absent or rudimentary portions of the müllerian system. In their developmental capacity the ovaries collaborate with the other organs of internal secretion. Our knowledge of the true secretory power of the gonads in early life, especially that of the ovaries, is meager and at the present time practically at a standstill. But we do know that they are reciprocal or balancing agents in their relation to other more powerful glands like the hypophysis, and that their presence is essential to normal bodily evolution. Castration, therefore, before puberty is justly regarded as an irremediable disaster and is never resorted to excepting as a life-saving measure.

During adolescence, although the genital organs have assumed the function of reproduction, the ovaries continue to exert their reciprocal influence for development, so that the necessity of castration at this period is also a serious misfortune.

Fortunately the surgeon is rarely called upon to ablate the ovaries during childhood and then only in cases of neoplasms which usually indicate some congenital defect and which have already by their growth damaged the processes of development. During adolescence the serious conditions that may occur from gynatresia or specific infections can usually be met by a wise conservatism which though it may not restore the power of reproduction, will at least preserve the ovarian and uterine functions so necessary for the full maturity of womanhood.

Most of the problems of conservation that confront the surgeon are met with in patients who have reached or passed the age of maturity, which with somewhat wide variations may be set at twenty-two years. For the solution of these problems, one must adopt a new valuation of the genital organs.

No one will deny that the genital system of a woman was designed by Nature ultimately for reproduction. It must be granted, therefore, that it is the surgeon's duty to follow Nature's purpose, and in every way consistent with the patient's health and life, to endeavor to conserve or restore reproductive power. To this obviously righteous doctrine members of the profession do not react uniformly on account of a difference of opinion as to what constitutes the welfare of the patient. Thus during a given operation a conscientious operator may adopt contraceptive measures which to another surgeon, equally conscientious, would be inexcusable. And therein lies the problem.

But in addition to the reproductive function of the genital system there is another which is less distinctive and about which there is

decided disagreement, namely, the influence on the bodily organism of the internal secretion of the adult ovary. That there is such a secretion and that it has an influence on the organism is generally accepted. But the nature and origin of the secretion and the importance of its constitutional effects are matters not so well established. The question of ovarian influence is the keynote of many a pelvic problem. Long before hormones were ever discovered it was the popular belief that the loss of ovaries doomed a woman to eunuchoid transformations, such as increased facial pilosity, deepening of the voice, masculine temperament and other changes the existence of which depended on superstitious imagination rather than on scientific fact. Nor has the fallacy completely passed. Believers in this doctrine fail to observe that a normal woman is as feminine and motherly after the natural menopause as she was before she lost her ovarian secretions, and often more so. There are still members of the profession whose character analysis cannot stretch beyond the horizon of sex, who are as firmly convinced that the nature of woman is centered in her gonads, as was Rene Descartes that the human soul resides in the pineal gland. They seem not to realize that woman is woman not only in her sexual apparatus but in every fiber of her being, in her skin, her contour, her bones, her internal organs, and above all, in her brain cells and mental processes.

Now when we come to inquire what palpable, unmistakable changes take place after the natural or artificial menopause which may be connected in a definite causal relationship with the loss of ovarian function, we find that there are only two, namely, atrophy of the other genitals, which is inevitable, and vasomotor disturbances, mostly in the form of hot flushes, which ensue in the majority of cases. Each of these conditions may be so severe as seriously to impair the patient's health, but such an outcome is exceptional and usually indicates, as we shall see later, some specific constitutional defect in the patient's make-up. Aside from these two unpleasant but comparatively unimportant sequelae, we have never been able to observe in otherwise normal women any profound physical, spiritual, or sexual changes that might be consistently ascribed to the loss of the ovarian secretion. Nor have we ever been able to identify, or even take much stock in, "ovarian deficiency" as a specific disease unassociated with other glandular or neurologic defects. It is our conviction, therefore, after many years of study of gynecologic patients, that the adult ovary though supreme as an organ of reproduction, is greatly overrated as a gland of internal secretion, and that when ovarian ablation becomes necessary it portends no great catastrophe to the patient's future happiness and well-being.

*Woman's Valuation of Her Sex Apparatus.*—We shall now turn our attention to that phase of our subject which deals with the reaction of woman to her own genital system, for it is obviously important to give some consideration to what the patient herself thinks of the loss or retention of organs which the surgeon with so little thought daily subjects to the knife. And here we are approaching dangerously near that mysterious realm, the psychology of woman, which it is said has never been satisfactorily exploited either by man or woman. Very likely that is true, but when all has been said we cannot help feeling that the mystery of woman has been exaggerated. “*Varium et mutabile semper est femina*,” said Virgil. But her very mutability can be relied upon, and calculated in advance. Mercury is labile, but it follows certain physical laws of gravity and friction, and its motions can be accurately foretold. The chief reason why woman is so great a mystery to man is that he ascribes to her nature his own instincts, motives, and mental processes, and is thereby continually astonished that she does not react as he does to the same stimuli. Man and woman are complementary and necessary to each other, but they are far from being identical in their physical and mental composition. With this truth as a basis much of the mysteriousness and incomprehensibility of woman's nature disappears. It is not our purpose to attempt a differential exposition of female psychology, but only to allude to a few sexual reactions which may be of use to us in deciding some of the questions of organ conservation.

The maternal instinct is undeniably the most powerful agent in woman's character, but the instinct of maternity is another matter, and at least in modern civilization is comparatively feeble. If, among those of our patients who are most solicitous to become fertile, we search for the true motive of their desire, we will find, in the majority of cases, that it lies not in an overwhelming natural instinct for childbearing, but is prompted rather by the instigations of an impatient partner. In other words we find that the instinct for parenthood is stronger in the male than in the female, and for that reason the loss of procreative power is less of a disaster to a woman than to a man. There are of course numerous exceptions to this general rule. When the child is born the reaction in the father is one of pride and self-satisfaction. In the mother is awakened the supreme joy of motherhood, which far outweighs her previous fear of conception and the pains of labor.

We shall now consider the organ consciousness, or perhaps we might better term it the localized sex sensibility of woman. This, be it said, is only a small part of her general sex consciousness, a subject that would involve nearly the whole field of her psychology and one that is too broad for the scope of this paper.

In the matter of organ sensibility, normal men and women are not on the same footing. The female genital organs being concealed and normally insensible excepting under sexual excitation are not an object of contemplation unless they are diseased. The woman whose mind is riveted on her perineum or her uterus or her ovaries is classified as a neurotic. Even the clitoris reflexes are comparatively feeble. If they are very active the woman is said to have masculine attributes. If they are equal to the corresponding reflexes of even the average male, they are regarded as abnormal and as indicating at least a nymphomaniacal tendency. A patient thus afflicted is subjected to a search for some source of local irritation or of neuro-pathic excitability. As compared with men, normal women crave affection, attention, and admiration, sexual intercourse being rather a means than an end. Hence, it is that during active sexual life, to the majority of women an amputation of the breasts or the partial closure of the vaginal orifice is a greater calamity than the removal of the uterus and its appendages.

Woman's valuation of the menstrual function is a subject on which surgeons disagree in solving some of the problems of conservation. There is no doubt that a woman who menstruates normally looks with satisfaction on the function, troublesome as it is, as an indication of health and complete womanhood, but it is impossible to believe that any woman regards the catamenial curse in itself as anything but an unavoidable nuisance. Deficient menstruation, especially when attended with pain, is a constant reminder of incompleteness, a suggester of inferiority, a fertile producer of neuroses. Absence of menses, on the other hand, is often a relief, and is a condition to which most women soon become contentedly adapted. And yet operations are advocated in the treatment of pelvic diseases, which by preserving scanty portions of the endometrium and ovaries, maintain a meager semblance of menstruation. These mutilated pelvic relics, with their incomplete function, seem to us to be only grim reminders of misfortune, and an incessant and prolonged irritant to the patient's nervous organization.

In our study of woman as an individual we have reached the following conclusions as a practical aid in deciding certain of the problems of organ conservation.

1. Before the age of maturity every effort should be made to preserve the full function of the pelvic organs because of their influence on general development.
2. After the age of maturity, preservation of reproductive ability is the prime consideration. If this is not possible every effort should be made to maintain the full menstrual function. After the age of thirty-five, these requirements become progressively less stringent.

3. If, for the welfare of the patient, reproductive ability and full menstrual capacity must both be sacrificed, complete ablation is preferable to resections and transplantations that result in the scanty semblance of menstruation.

4. The surgeon should be cognizant of the patient's personal and domestic reactions to the question of conserving her organs, and should in all cases be armed with the permission to do during the operation what in his judgment is best for the patient's future welfare.

5. If after full maturity, ablation is necessary, the patient is not unsexed in the popular sense, since sex is a universal and not simply a local physical attribute; nor are the other organs of internal secretion, excepting in unusual instances, permanently disturbed.

With this somewhat discursive introduction, we shall now take up the main topic of our paper, namely, the technical problems of organ conservation. In these problems are involved questions of reproduction, pelvic mechanics, pathology, and endocrinology. Some of the factors are simple, others combined, still others antagonistic. We shall consider them with special reference to the organ concerned and shall begin with the uterus.

*Conservation of the Uterus. Fibroids.*—The most important phase of uterine conservation is met with in the childbearing period, and the chief point at issue is that of reproduction. Fibroids are the enemies of reproductive power. They are often the cause of sterility. Associated with pregnancy they constitute a dangerous complication. If allowed to grow they may necessitate the removal of the uterus and thus prevent forever the possibility of conception. If one is willing to sacrifice fertility, the treatment of uncomplicated uterine fibroids has become one of the easiest tasks of the pelvic surgeon. The operation of supravaginal hysterectomy is so well standardized that it can be done rapidly, bloodlessly, and safely. The mortality risk is low, and the future well-being of the patient may be almost guaranteed. Furthermore, the moderate risk of the operation can in many cases be avoided by a single sterilizing dose of radium, combined if necessary, with x-ray, with the promise of a high percentage of satisfactory results. These safe resources for combating the dangers of fibroid tumors represent a great advance in pelvic surgery, and are plainly an inestimable boon. But have they not led many of us to take the easy path and to neglect our duty in respect to conserving the reproductive power of our patients? Has not the more difficult and dangerous operation of myomectomy been too frequently supplanted by the simpler but more radical procedures of hysterectomy and irradiation? In our opinion the operation of myomectomy has not been sufficiently developed. The uncomfortable convalescence and danger of rupture in later pregnancies, well-known drawbacks to the operation, have been taken too much for granted. Regarded as necessary sequels, too little attempt has been made to avoid them. In this way the operation has attained an undeserved ill repute.

In this discussion of the operation of myomectomy we do not refer to the simple enucleation of small fibroids which every surgeon does as a routine, but rather to the treatment of those larger tumors, the removal of which, either on account of their size or location, appears more or less formidable. The disagreeable results of this operation are sufficiently familiar. The convalescence is apt to be stormy, with much abdominal pain and intestinal distention, often a rapid and alarming pulse, slow recovery, and later symptoms of postoperative adhesions. Too frequently we hear of a ruptured uterus during a later pregnancy, the result of a thin, incompetent scar.

From our study of myomectomy cases we are convinced that the evil results of the operation are chiefly due to imperfect technic. The operation of myomectomy is an art in itself, and requires the best skill of the plastic surgeon. It is not a mutilation, but a reconstruction. As in all plastic surgery the watchword should be "hemostasis and approximation." Bad form in myomectomy is represented by rough scooping out of the myoma with the hand, or blunt instrument; incomplete ligation of the blood vessels; tying the final sutures too tightly in order to control bleeding; and leaving a ragged, unsightly wound. Clumsy work of this kind results in hematomas in the uterine wall with destruction of the muscle fibers, oozing of blood into the peritoneal cavity with consequent peritoneal irritation and bowel stasis, thin scars, and postoperative adhesions. In order to avoid these untoward mishaps we recommend the following technic:

First of all must be borne in mind one of the basic laws of surgery, that muscle tissue should not be compressed too tightly by sutures since the muscle fibers are thereby destroyed, and the wound eventuates in a thin, incompetent scar. Hence the incision for the removal of a good sized fibroid should be made so that the wound edges may finally be approximated with a minimum amount of tension. For this purpose it is convenient to make flaps in the manner of an amputation of the leg. After the tumor has been exposed and the plane of cleavage found, it is a temptation to rip out the mass with a few vigorous flourishes. This is a grave mistake, for after such handling it is impossible to isolate and clamp the individual bleeding points and it then becomes necessary in order to control hemorrhage to place mass sutures, which on being tightly tied compress and destroy great numbers of muscle fibers. The tumor mass should be removed slowly and carefully, every bleeding vessel being clamped as it appears. Tension on the tumor brings the bleeding wall of the uterus into view and facilitates the hemostasis. The best method for tying the vessels is to sew in figure-of-eight ligatures about the clamps, otherwise there is danger of slipping and secondary hemorrhage when the uterine wall contracts. No attempt should be made to close the wound until every bleeding vessel is conscientiously tied and the whole field completely dry. In closing the uterine wound, several layers of sutures are applied in order to divide the tension and to make the approximation as broad as possible. For closing the peritoneum we recommend the use of the subcutaneous stitch employed by E. B. Piper in his cesarean section operation, as it best insures against the leaking of blood into the peritoneal cavity. For the



shorter wounds either the single or double figure-of-eight suture may be used as it secures good approximation with a minimum knot exposure. Every effort should be made, especially when multiple enucleation is required, to preserve as far as possible the natural contour of the uterus.

Since the operation of myomectomy is designed to preserve reproductive power, the endometrium should be religiously guarded. If considerable portions of the mucous membrane must be sacrificed in the effort to enucleate the tumors, the operation loses its point and hysterectomy should be performed.

The possibilities of reconstructing a uterus after myomectomy may be learned by practice-dissection of a specimen freshly removed by hysterectomy.

*The Uterus and Adnexal Disease.*—Another question relating to the conservation of the uterus, a mechanical one, is met with in cases where removal of the adnexa is necessary, as for example in the treatment of bilateral ovarian cysts. The uterus lying free in the pelvis, deprived of its adnexa, is a superfluous organ, and usually produces general pelvic discomfort. Less trouble is encountered if it is suspended to the abdominal wall, but in general it may be accepted as a surgical principle that if the ovaries must be sacrificed the uterus should at the same time be extirpated.

*Procidentia.*—There are numerous procedures in the treatment of prolapse and procidentia which entail either a removal of the uterus or putting it out of commission as an organ of reproduction. The questions here involved are both mechanical and functional. From the standpoint of mechanics our experience leads us to believe that the most effective means of permanently curing prolapse is by the suspension method. The suspension principle can best be carried out by employing the uterus and its round ligaments as a medium of attachment. It is our custom, therefore, to conserve the uterine body even in the most extensive cases of procidentia. From the standpoint of preserving fertility and the menstrual function, we find the suspension principle the most satisfactory, as it provides both for the relief of the prolapse and for future childbearing.

*Conservation of the Cervical Stump.*—The next topic for discussion is the question of removing the undiseased cervix during a routine hysterectomy as a prophylactic measure against a possible future cancer. As Dr. Polak is the most eminent champion of complete versus supracervical hysterectomy, I will briefly review his conclusions, with which no doubt you are all familiar.

Dr. Polak in the two papers which he has written on the subject, "Incidence of Cancer in the Cervix Occurring in the Retained Stump After Supracervical Amputation for Fibroids," and "Total Hysterectomy in Fibroid Tumors of the Uterus," confines his observations to operations for uterine fibroids. He calls attention to the compara-

tive frequency of the coexistence of myomas and cervical cancer, shown by Schottländer, Spencer and Noble in a series of 900 total hysterectomies to be 2 per cent. On account of this menace of malignant development in the retained cervical stump, he advocates total hysterectomy as the operation of choice in all cases of fibroids where the removal of the uterus is necessary. As to the advantages claimed for the supracervical method, namely, ease and rapidity of execution, better anatomic results, and a lower percentage of morbidity and mortality, Dr. Polak points out that they have been considerably exaggerated and do not compensate for the danger of a later cancer. In his own series of cases he finds that his mortality percentage is only 0.5 per cent greater after total than after subtotal hysterectomy.

Dr. Polak's articles on the subject like all his published observations carry conviction, based as they are on incontestable facts and extensive experience. The controversy, if there be one, is founded not on principle but on expediency, as I shall attempt to show.

In my own work I have been a warm advocate of the supracervical technic chiefly on account of its ease and rapidity of performance, and because it does not expose the abdominal cavity to possible contamination from the vagina and cervix. In carrying out this policy, however, I have had conscientious regard for the cervix. When a lacerated, inflamed, or eroded cervix is present, we have considered a cervical repair combined with a subtotal hysterectomy as better safeguarding the interests of the patient than complete extirpation. In cases of doubt, frozen sections are made from the cervical tissue and examined before the abdominal operation is undertaken.

In order to determine whether or not our method is justified by the results, I have reviewed my personal hysterectomy cases up to February 1, 1926, taken both from the Free Hospital and private records. That the review may be more comprehensive I have included not only fibroids but all sorts and conditions of pelvic disease for which the operation of hysterectomy has been deemed necessary. Coning out the endocervical canal is counted as a supracervical hysterectomy, an operation which we employ for severe endocervicitis, or in certain cases of body cancer in elderly or obese patients, and where rapidity is desirable on account of some serious constitutional disease.

#### SUPRAVAGINAL HYSTERECTOMIES (PERSONAL CASES)

For Fibroids .....		754
Deaths.....	6	Mortality per cent..... 0.79
Causes of death:		
Cerebral hem.....		1
Pulm. embolism .....		2
Peritonitis .....		1
Acute nephritis .....		1
Shock .....		1
		<hr/> 6

For All Conditions Including Fibroids.....	1399
Deaths..... 22      Mortality per cent.....	1.57
Causes of death: Shock .....	3
Septicemia .....	1
Peritonitis .....	2
Typhoid .....	1
Pneumonia .....	2
Acute nephritis .....	1
Embolism (pul.) .....	4
Cerebral hem. ....	1
Intestinal obstruction .....	1
Myocarditis .....	1
Secondary hem. ....	1
Ligated ureters .....	1
Slow exhaustion .....	3
	<hr/>
	22
Cancer of Cervical Stump (Personal Cases) (Known)	
Late occurrence .....	4
Not diagnosed at operation.....	1
	<hr/>
	5
Cases Seen from Other Clinics	
Late occurrence <sup>1</sup> .....	6
Not diagnosed at operation.....	12
Doubtful .....	1
	<hr/>
	19
Total Cases Seen	
Late occurrence .....	10
Not diagnosed at operation.....	13
Doubtful .....	1
	<hr/>
	24

#### FATALITY IN CANCER OF THE CERVICAL STUMP

Late Occurrence	
Dead .....	5
No answer .....	2
Living with recurrence.....	2
Living without recurrence .....	1
	<hr/>
	10
Not Diagnosed at Operation*	
Dead .....	6
No answer .....	3
Living with recurrence.....	3
Living without recurrence .....	2
	<hr/>
	14

<sup>1</sup>One of these patients was operated upon at the Free Hospital by another member of the staff.

\*The "doubtful" case is included in this list.

## COMMENTS

In collecting the above statistics it has been interesting to note a marked diminution in the number of hysterectomies performed during the last five or six years. This has been due, first, to an increase in the number of myomectomies in cases formerly treated by hysterectomy; secondly, to the substitution of radium in the treatment of uterine insufficiency and the smaller fibroids; and thirdly, to the practice of conserving the uterus in all cases of procidentia.

In the mortality statistics of supravaginal hysterectomy both for fibroids and all conditions, we call attention to the comparatively small number of deaths from peritonitis and shock. It is from these two factors that we claim vindication for our policy in employing the subtotal operation, for we feel that the figures would have been much larger had we attempted a complete hysterectomy in all cases.

It is to be noted that of the total number of cases of cancer of the cervical stump seen, the majority probably had the disease at the time of the original operation. These undiagnosed cases can hardly be used as an argument against subtotal hysterectomy provided due care is exercised in investigating the cervix.

The list of deaths from cancer appearing in the cervical stump demonstrates the fatality in this class of cases, and constitutes a legitimate argument in favor of total hysterectomy.

When cancer occurs in the cervical stump we recommend operation in preference to radium, though we recognize that the majority of cases when seen are beyond the reach of surgery.

From these figures we may derive certain impressions, which though not in the nature of absolutely proved conclusions, are nevertheless of some value as guides to surgical conduct.

1. The mortality percentage in supravaginal hysterectomies for fibroids is low. If total hysterectomy had been carried out as a routine, we are confident that in our hands, at least, the number of deaths would have considerably exceeded the incidence of cancer in the cervical stump.

2. The mortality percentage in supracervical hysterectomies for all causes, though much higher than that for fibroids, is, nevertheless, satisfactorily low, considering the desperateness of many of the cases. In the more difficult cases we feel that a total hysterectomy would often have subjected the patient to a risk greater than that of a later cancer in the stump.

3. If total hysterectomy is to be employed as a routine for fibroids, consistency demands that it be used in all cases requiring hysterectomy, especially in pelvic inflammatory disease.

4. A patient who dies from an operation is irrevocably dead. One who survives the operation but develops a later cancer of the stump has a definite though small chance of being cured of the cancer.

Dr. Polak's work sounds a note of warning to those of us who are not ready to give up the subtotal operation. When the cervix is in doubt total hysterectomy is the operation of choice. Subtotal hysterectomy should never be undertaken unless the cervix has been subjected to careful examination and necessary treatment.

*Conservation of Ovaries During Hysterectomy.*—The next problem, conservation of the ovaries during hysterectomy, is one that I present with an apology. The subject is so hackneyed that a full discussion of it would be but a tiresome repetition of time-worn arguments. I shall, therefore, be brief in my comments.

What are the facts in the case? On the one hand competent surgeons, conscientious observers, religiously conserve ovarian tissue when possible during hysterectomy in the belief that the ovaries by themselves continue to exert a beneficial influence on the patient's organism. Statistics show that their results are good. On the other hand surgeons of equal experience, and equally conscientious in their observations, religiously ablate the ovaries during the same operation in the belief that ovarian relics may be injurious. Their statistics also show good results. There is but one conclusion that can be drawn from this situation, and that is, that in treating the average woman it makes very little difference whether in the course of a hysterectomy, the ovaries be retained or ablated, the ultimate results from both methods being excellent in a high percentage of cases. In our own work we remove the ovaries chiefly because if retained they may give later trouble, either from cystic degeneration, adhesions, or even malignant change.

Another inevitable conclusion is that normally the ovaries of an adult woman are of no great importance as organs of internal secretion. But it would be a mistake to say that they have no such influence, since an occasional hysterectomized patient is encountered who exhibits prolonged vasomotor and neurotic symptoms that appear to date from her operation. Patients of this kind are seen in both the retention and ablation groups, and it is over them that the dispute in the matter has chiefly been waged. No one has definitely proved that they are more common in one group than in the other. It is therefore a not unreasonable inference that these untoward results are to be ascribed not to the form of operation but to a particularly unstable type of female organization that is thrown out of gear by the menopause.

In this connection we must mention the effect of radium on menstruating women. In our experience we can recognize no difference between the after-results of a sterilizing dose of radium and those of a hysterectomy with ablation of the ovaries. We have been interested to note that the statistics compiled by Dr. Corseaden of the Presbyterian Hospital showing the results of radium treatment are almost identical with our own figures from hysterectomy in relation to flushes, nervous symptoms, libido sexualis, etc.

*Conservation of the Adnexa.*—Problems of adnexal conservation are based on two main principles: first, that of restoring fertility, and sec-

ondly, that of preserving the menstrual function. Operations of this kind are exceedingly interesting to the reconstructive surgeon and test his plastic skill. We shall discuss the subject first from the standpoint of relieving or preventing sterility. Of foremost importance is the treatment of the ovaries. The single layer of germinal epithelium that covers the ovaries is extremely delicate and easily desquamated. The surface, therefore, is especially susceptible to traumatism and infections with resulting adhesions. In long-standing pelvic inflammatory cases the ovarian adhesions become very tenacious, and as the ovarian tissue is friable it is often difficult to extricate the organ from its bed without severely lacerating it or leaving valuable portions of it adhering to the pelvic wall. This does no particular harm if one's final object is a hysterectomy, but if the aim of the operation is conservative, there must be as little sacrifice of ovarian tissue as possible. It is, in my opinion, a great fallacy to believe as we were once taught that one ovary is as good as two, or that half an ovary is as good as one, or that a small bit of ovarian tissue is all that a woman requires. It is important both for reproductive and menstrual purposes that as much ovarian tissue should be saved as possible, and in order to accomplish this it is necessary to carry out the dissection with painstaking care. If the blood supply of the ovary is properly guarded, laceration, even though extensive, does no great harm since the organ can be surprisingly well restored to its original form by the exercise of ordinary plastic ingenuity. In many cases an ovary that has been implicated in an infection, especially if it be that of the puerperal or appendical type is not especially adherent but is invested with a fibrinous envelope that may completely prevent the extrusion of an ovum. Ovaries of this kind may occur in association with tubes that are pervious to insufflation. The careful removal of the fibrinous investment is sometimes the determining factor in restoring fertility.

In the treatment of retention cysts which are of such size as to require removal on account of the danger of torsion or necrosis, it is often possible by careful dissection to preserve a large percentage of the ovarian tissue even though it be well spread out over the surface of the tumor. These flattened ovaries retain their function, and may be rolled and stitched into a very respectable resemblance to their natural contour. The same principle of conservation may be applied to some of the smaller dermoids, and as we shall see to the chocolate cysts.

Conservation of the tubes is a subject technically too extensive for the scope of this paper, and we shall allude only to some of the basic principles involved. In undertaking a plastic operation on a tube, the question of patency throughout its entire length is of course of first importance and on account of the valve-like action of

the lumen at the isthmus, is better determined by insufflation from below than from above. The prospect of success is greatly influenced by the nature of the pathology, and this may, in perhaps the majority of cases, be ascertained by the patient's history and the appearance of the pelvic organs. If the obstructing adhesions are the result of appendicitis or puerperal sepsis, the prognosis is more hopeful, since the infective process is perisalpingeal, and there are excellent chances that, protected by the closure of the fimbriae, the endosalpinx is undamaged. Gonorrhea on the other hand, attacks first the tubal mucosa and is especially apt to close the opening at the isthmus in which case, naturally, plastic operations on the tube are usually futile. In the presence of tuberculosis, tubal conservation is not to be thought of.

One of the unrealized ideals of pelvic surgery is the consistently successful transplantation of ovarian tissue in the horns of the uterus when salpingectomy is necessary. The few authentic cures of sterility by this means, encourage us to hope that the operation both of auto- and heterotransplantation may sometime be perfected. Such an event would mark the dawn of a new epoch in practical gynecology.

The results of conservative surgery in pelvic inflammatory disease, it will be agreed, are not always brilliant, but it is certain that the operation is somewhat in the nature of a game of skill, and that delicate dissection and precise peritonization of raw surfaces add greatly to success both in the matter of symptomatology and of restoring the possibility of conception.

Conservation for the sake of maintaining menstrual function, conception being impossible, should always be practiced when possible in treating young women, the necessity diminishing as the patient approaches the climacteric. To this there can be no dissent. But the limit to which conservatism should be carried is a matter of disagreement. My personal opinion on this subject has already been intimated in the introduction to this paper. I need only repeat that I believe that preservation of the menstrual function is desirable only if it be complete. For this purpose at least the major part of one ovary and the major part of the endometrium should be present. I can see no advantage in those operations, interesting as they are from a physiologic viewpoint, which seek to maintain the appearance of menstruation by a distant transplantation of ovarian tissue. It has been our observation that patients in whom scanty portions of ovulating and menstruating tissue have been left, are apt to undergo nervous symptoms which though delayed for a time, appear sooner or later and are often prolonged for many years. It has therefore been our maxim that the dysfunction resulting from incomplete menstruation gives more ultimate trouble than do the immediate routine menopause symptoms that follow complete ablation.

*Endometriosis.*—The last subject which we shall consider is the question of conservation in the treatment of pelvic endometriosis. It requires discussion first from the standpoint of ovarian implants (chocolate cysts), and secondly from that of the more distant implants, the formerly so-called ectopic adenomyomas. When Dr. Sampson published his first paper on the chocolate cysts of the ovary and recommended radical removal of the pelvic organs, we were somewhat disturbed because in the past though ignorant of the nature of the growths, we had treated them conservatively whenever it was feasible. A review of our cases, however, showed generally good results, and we therefore continued our practice. Dr. Sampson has since changed his views in favor of conservatism. Unless the destructive process has been too extensive, chocolate cysts can often be removed with the retention of competent portions of the ovary. Since the tubes are usually not seriously damaged such conservatism is particularly desirable. Several of our patients who previous to the operation were sterile have afterwards conceived and borne healthy children. We have not observed any definite tendency to recurrence after conservative surgery.

The treatment of extragenital endometrial implants (ectopic adenomyomas) is quite a different matter from that of the chocolate cysts of the ovary. Some of these tumors appear to be limited in their growth and are sufficiently innocent. Others, notably those of the posterior culdesac and rectovaginal septum, assume a character that is clinically malignant. Since their nature of growth is infiltrating, surgical removal does not prevent a recurrence. On the theory that the activity of an endometrioma, like that of its progenitor, the endometrium, is dependent on the ovary, we have successfully treated a number of cases by hysterectomy and complete ablation of the ovaries. Our conclusions and illustrative cases have been published in the Transactions of the American Gynecological Society of 1925.

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198 COMMONWEALTH AVENUE.

(For discussion, see page 291.)



A CONTRIBUTION OF THE BIOMECHANISM AND THE  
PATHOLOGY OF ECTOPIC PREGNANCY, WITH  
A CONSIDERATION OF SOME OF ITS  
CLINICAL PHENOMENA\*

BASED ON A STUDY OF ONE HUNDRED AND THIRTY-ONE CASES

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(Continued from July)

II. THE BIOMECHANISM AND THE PATHOLOGY OF EXTRAUTERINE PREGNANCY

The array of data furnished by the study of the above cases warrants a consideration of the following problems:

1. How closely does the biomechanism of ectopic gestation simulate intrauterine pregnancy?

2. Do purely mechanical or mechanopathologic causes of an obstructive nature really play so important a rôle in the etiology of extrauterine pregnancy as is ascribed to them; and if not what may the other factors be?

3. Is the clinical terminology, "tubal abortion" correct?

4. What is the pathologic physiology of uterine bleeding in ectopic pregnancy?

1. *How closely does the biomechanism of ectopic gestation simulate that of intrauterine pregnancy?* As soon as the intrauterine ovum is ripe for placentation it burrows its way subepithelially, enters the compact and richly vascularized portion of the endometrium, and establishes its lacunar circulation. It accomplishes the latter through the arrosion of the capillaries by the chorionic villi, thus bringing the maternal blood into immediate contact with the fetal ectoderm. The bleeding attending this process is so slight that no harm accrues to the placental circulation. Under normal conditions the chorionic villi rarely if ever encroach upon the uterine musculature, and its blood vessels are consequently spared the arroding effects of the trophoblast. As the embryo grows it lifts the overlying mucosa more and more towards the uterine cavity, which stands out in marked contrast to the rest of the uterine lining. The raised portion is termed the decidua reflexa, while that lining the uterine cavity, the decidua vera. With the still further growth of the fetus these two endometrial layers meet and fuse, and in the latter months of pregnancy they form one continuous structure.

If for some reason or other the impregnated ovule tarries too long within the oviduct, its potentialities for placentation mature, and the

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\*Read before the Brooklyn Gynecological Society, and the Section of Obstetrics and Gynecology of the New York Academy of Medicine.

tubal nidation results. And just as the intrauterine egg does not stay upon the surface of the endometrium but buries itself within it, so does the tubal embryo leave the surface of the endosalpingium and find its way into the deeper structures of the tube wall. This biomechanistic principle of ovular nidation was first conceived in its true light by F  th, in 1898. Aschoff, K  hne, Werth, and many subsequent investigators verified these findings. My own inquiries harmonize with the above teachings, and not only do these principles apply to tubal pregnancies, but also to primary ovarian and to primary abdominal gestations. It is worth while to reiterate the pertinent facts concerning the mode of ovarian and abdominal nidation in this series. In the former instance, the ovum did not remain within the confines of the follicle, but penetrated beyond the granulosa boundary into the ovarian stroma and left the corpus luteum behind, as demonstrated in Fig. 36. This fact is not in keeping with the time honored teaching of Van Tussenbroek announced in 1893, that a true ovarian pregnancy must show the yellow body as a component part of the capsularis, but it is in full agreement with our recent knowledge of ovular implantation. In the abdominal pregnancy the ovum burrowed its way under the peritoneum, and began to form its nest in the walls of the adjacent viscera. We may, therefore, conclude that in a truly anatomic sense every ovular nidation is either subendometrial, subendosalpingial, subfollicular, or subperitoneal, according to the site it chose, or was forced to adopt as the point of anchorage.

If the process of nidation is alike in all types of pregnancy, why do the extrauterine forms pass from a physiologic beginning to a pathologic ending, at or about the sixth week of their antenatal life? Because the ectopic nest is inadequate quantitatively and qualitatively to harbor the growing ovum. This fact is well illustrated in the cases of tubal pregnancy. Since the endosalpingium does not suffice for the ovular implantation, the latter encroaches upon the muscularis. This only delays but does not obviate the ultimate rupture of the capsularis, which leads in most cases to the death of the embryo, and at times also to that of the host. This fact made Werth state, "Every tubal pregnancy must be considered as a malignant growth." The accumulated clinical experience since Werth's time necessitates the amplification of the original dictum, which ought to read, "Every ectopic pregnancy is potentially a pathologic condition, and should be operated upon as soon as diagnosed." The factors precipitating the tragic end of extrauterine gestations may be summed up as follows: (a) The excessive intracapsular bleeding, due to the arrosion of the blood vessels in the muscularis of the tube wall, which are much larger than the capillaries of the compacta; (b) the growing ovum, which stretches the poorly yielding envelop, and (c) the pro-

gressive weakening of the capsularis caused by the lytic action of the trophoblast. Some few cases of extrauterine pregnancy may go to term, but they are usually associated with distressing abdominal pains throughout the period of gestation, and the newborn show almost invariably some developmental defects.

*The formation of a reflexa in tubal pregnancy* was either questioned or denied by Aschoff, Fñth, Kühne, Kreisch, and others. My observations prove its formation beyond any doubt. The physiology of pregnancy teaches that a reflexa is an essential and vital part of its biomechanism; it keeps the lacunar circulation within definite boundaries, and thus secures a proper exchange between the maternal and the fetal blood streams. How then have these careful observers come to take a negative stand? The only cases in which an anatomically true reflexa is lacking are those in which the nidation remains strictly intramural, and the pregnancy develops in an outward direction. (Figs. 2 and 3.) But even in these cases the destined function of the reflexa is not abandoned; it is taken up by the capsularis, formed out of the muscle and connective tissue elements of the tube wall. If the opponents of the reflexa theory would have limited their contention to this type of cases, on purely morphologic grounds, their claim might be granted, but we must not admit its absence in general. A reflexal formation may also be missed in specimens examined after its fusion with the tubal mucosa, as is illustrated in Fig. 10, which is similar to the biomechanism found in the latter months of intrauterine pregnancy. But neither of these findings justifies the denial of a reflexa formation in ectopic pregnancy. We may sum up our views on the question of a reflexa formation in tubal pregnancy as follows: All pregnancies must have a reflexa to act as a limiting membrane for the lacunar spaces in order to maintain the placental circulation; but when the anatomic conditions are such as to prevent its classical formation, the capsularis acts as a substitute. As to the reason why some tubal pregnancies develop centripetally and others centrifugally, the theory of columnar and intercolumnar implantation of the ovum may serve as a working hypothesis. The thickness or thinness of the endosalpingium may perhaps also exert an influence upon the direction of ovular growth, the findings in Case 4 suggest these possibilities.

The *decidual reaction* in ectopic gestation forms another debatable and acrimoniously fought academic subject. Bland-Sutton and Griffiths deny its presence. Aschoff admits its formation but says, "if a decidua vera does form in the tube, it appears late—about the second month of pregnancy; that the maternal decidua serotina is either wanting in the preponderance of cases, or is only slightly developed, and that its description by many observers is erroneous, for they mistook the trophoblast for the connective tissue hyper-

plasia." Frankl and Schiller contend that the decidual formation is an hyperplastic response to an inflammatory stimulus. Robert Meyer states that "no extrauterine decidua forms without an associated or a preceding inflammation." Ulesco-Stroganowa on the other hand proclaims with equal conviction that "no decidua forms without a pregnancy." Leo Loeb produced deciduomata experimentally by introducing foreign substances into the uterine cavity, or by traumatizing the endometrium, and the following are some of his recorded observations: "Between the second and the ninth day after rut the experiments were not successful, and between the thirteenth and the sixteenth day they failed completely. If the ovaries were extirpated or the corpus luteum was cauterized, no decidua developed; and if rut was followed by impregnation, the decidual reaction was most pronounced. In the experimental deciduomata unassociated with pregnancy the endometrial glands did not participate in the hyperplastic phenomenon." Trankau-Reiner tested the decidual tissue of intra- and extrauterine pregnancies for glycogen, fat, oxydates, and peroxydates, and found great similarities in their biochemistry. I found decidual reactions in ectopic gestation with marked frequency, in varied amounts and in varied locations. Its paucity or total absence in some cases I ascribe, not to a failure on the part of the connective tissue elements to respond to the hormones of pregnancy, but rather to its destruction by the hemorrhages associated with the premature termination of ectopic gestation. My studies also fail to lend support to the upholders of inflammation as the prime factor in calling forth a decidual reaction in the connective tissue during pregnancy. As an illustration I can cite two cases of this series, in both of which evidences of a chronic salpingitis are present, yet the decidual reaction is very slight; on the other hand, the gravid tubes with a normal mucosa present a very pronounced decidual reaction. I have also searched for Hofbauer cells in the chronically inflamed tubes and have failed to find them, but I did find some clasmatocytes in the gravid tubes, which otherwise appeared to be normal. In consideration of these facts it is but logical and scientifically proper to look upon the extrauterine decidual reactions in the same light as we see the connective tissue hyperplasia of the endometrium, in intrauterine pregnancy; namely, reactions due to the stimulating effects of the internal secretions of the corpus luteum, placenta, pituitary, and the other synergists dominating the generative sphere.

As to the range of distribution of the extrauterine decidual reactions, my findings correspond with those of Orthmann, A. Martin, Garkisch, and Franque, Heincius, Pinto, Mandl and Webster. The site of greatest reaction is the placental area and the tissues in its immediate vicinity, as seen in Fig. 23, but more remote places also

show this hyperplasia. Walker, in 1887, and Dobert, in 1891, recorded decidual reactions in the subperitoneal connective tissue of the pelvis in cases of abdominal pregnancy. Schmorl found the same changes in normal gestation, which extended to the ovaries, the tubes, the omentum, the appendix, the lymph glands, and the diaphragm. Decidual reactions in the opposite tube have also been described. I can record decidual reactions in the subserosa of appendices; in the submucosa of the nonpregnant portions of the tube (Fig. 13), and in the subserosa of the oviduct at a distance from the gestation area (Fig. 24). Hofmeier found decidual reactions in the cervix, and Hofbauer in the walls of the vagina and of the urinary bladder. The blood vessel walls also form a favorite site for decidual hyperplasia. I have found it quite frequently. Fellner, Zedal, Mandl and Pinto, and Frankl and Stolper are of the opinion that this morphologic change takes place in the endothelium, while my findings point to a subendothelial metamorphosis, for in my specimens, the endothelial layer retained its normal outline and appearance; Figs. 7, 8, and 37 verify this claim. The endometrium in cases of extrauterine pregnancy shows the same proliferative alterations as if the pregnancy were located within the uterine cavity, as illustrated in Figs. 14 and 31. In the case of primary ovarian pregnancy the connective tissue in the blood vessel walls was the only place where a decidual reaction was noted. Schiller observed this change in the septae of an ovarian pregnancy. As a curious find Hofbauer reported the presence of decidual cells in the larynx during pregnancy. (This probably accounts for the change of voice noted in pregnant women.)

Synthesizing all of the above cited experimental, pathologic, and clinical data, the following dicta may be formulated: (a) The biomechanism of extrauterine pregnancy simulates the intrauterine form, in the manner of ovular nidation, in the building of a reflexa, and in the decidual reaction manifested by the connective tissues. (b) A true reflexa in the anatomic sense, is wanting in those cases in which the pregnancy remained intramural, and developed outwardly, in such cases the capsularies formed by the tube wall, played the rôle of the reflexa. It may also be missed in cases in which although the pregnancy developed towards the tube lumen, the specimen was examined after the fusion between the reflexa and the vera has taken place. (c) The theory of inflammation as a cause of decidual proliferation does not stand the light of recent biologic studies, for the extrauterine connective tissue is morphologically, genetically, and functionally (biochemically) identical with that of the uterus, and should therefore respond to the same hormones which activate the latter. Unterberg's definition of extrauterine decidua embraces this concept, it reads "connective tissue cells outside the uterine cavity

which undergo decidual changes during pregnancy.” (d) The quantitative and qualitative insufficiency of the nidation bed of an ectopic pregnancy is responsible for its transformation into a pathologic condition.

2. *Do mechanical or mechanopathologic conditions of an obstructive nature play so important a rôle in the etiology of extrauterine pregnancy, as is ascribed to them; and if not, what may the other causes be?* Since the advance of cellular pathology our concept of disease is centered around and upon morbid anatomy. As a result the etiology of ectopic gestation was built upon a system of hypotheses and theories resting on inflammatory, neoplastic, or congenital bases. Each of these causes is assumed to act as a physical barrier to the onward progress of the ovum, and hence its ectopic nidation. To properly evaluate their importance we shall review briefly the various theories propounded thus far.

*Salpingitis*, of gonorrheal, tuberculous, or coli origin, is accepted in the order mentioned, as the most frequent cause of tubal gestation. It is postulated by many authorities such as Henig, Hitschmann, Kermanner, Orthmann, Paltauf, v. Franque, Williams and others, that by the agglutination of the inflamed tubal folds, meshes are formed in which the migrating ovum is trapped, and forced to form its placental attachment within the tube. Veit took a negative stand to this theory and stated that “if simple mechanical causes such as a network formation within the tube is sufficient to hinder the ovular migration, then every conception ought to result in a tubal pregnancy, for the mucous folds of even normal tubes are so prominently developed.” Veit might have carried this idea a little further and should have stated, that if mucous folds were in any way conductive to tubal nidation, then most conceptions ought to result not only in tubal forms, but also most frequently in an ampullar type; for according to Sobotta, the mucosa of this portion forms “a complicated labyrinth composed of numerous capillary spaces.” In my experience the isthmial and the ampullar types occurred with equal frequency. Furthermore, in my series of one hundred and twenty-nine cases of tubal pregnancy macroscopic evidences of inflammation were present in only 18 per cent and the microscopic findings of intratubal inflammation were very few indeed. I have stained many specimens for plasma cells for corroborative proof of gonorrheal infection, with negative results. I have also found that in the gravid tubes with definite signs of chronic salpingitis, the nidation area failed to show this lesion; giving the impression that the ovum refused to implant itself on an unhealthy soil. The specimens with fully developed reflex showed normal mucous folds on the maternal surface. All these observations indicate that the theory of inflammation and agglutination

of the tubal folds as a cause of tubal pregnancy, is not as tenable as its promulgators claimed.

Veit, Depaul, Hohne, Phillips, Schroeder, and others, believe that the loss of the ciliated epithelium in the diseased tubes, is a far more potent factor in the causation of ectopic pregnancy than the reticular formation of its folds, for the following reasons: (a) because they fail to propagate the ovum onwards, and (b) because their absence favors or hastens tubal nidation. Pinner, in 1880, and Werth, in 1904, discredited this theory by finding active ciliary motion in fresh specimens of ectopic pregnancy close to the gestation site, and also in acutely inflamed tubes. I can substantiate these facts, for many of my specimens show a well retained ciliary covering.

*Adenomyosalpingitis* as an etiologic factor of tubal pregnancy was also accepted by many authorities; firstly, because this lesion is supposed to represent the end-result of chronic salpingitis, and secondly, because it is believed to form a mechanical hindrance to the ovular migration. Regarding the pathogenesis of adenomyosalpingitis, I have expressed my views in a previous publication (*Surg. Gynec. and Obst.*, July, 1925), and shall therefore not indulge in reiteration, but I do wish to state now, that in the few instances in which I have encountered this lesion, in association with tubal pregnancy, it bore no relation to the pregnancy, as proved by the total freedom of these gland spaces from any products of gestation.

*Tubal diverticulitis*, congenital or acquired, constitutes another theory of tubal pregnancy. Füth, Hufmann, Hohne and Kramer, Micholitsch, and Andrews, laid great stress upon this anomaly as a cause. A careful perusal of some of these communications convinced me that they are mainly repetitions of previously recorded statements and not the result of personal experience. Veit discarded this theory. My experience is limited to one but very instructive case. In Figs. 4 and 5, a wide-mouthed diverticulum is seen communicating freely with the tube lumen, and yet the ovum did not lodge in it, but in the tube wall opposite to it.

I have thus far enumerated the intratubal structural changes which are assumed as causes of ectopic gestation, and I shall now consider the extratubal conditions which are supposed to contribute towards this pathologic state.

*Bands and adhesions* were present in 6.25 per cent of my cases, but I have no criteria to prove the authenticity of these lesions as the cause. In the vast majority of my cases the serosa of the pregnant tubes was smooth and glistening.

*Ovarian tumors* pressing or distorting the tube lumen were accepted as etiologic factors, by L. Fränkel, Rosenstein, Arnold and many others. My experience with this lesion as an associated factor, is limited to two instances, but in neither of these cases did the ovarian

tumors indicate by their location that they had in any way compromised the permeability of the oviduct.

*Uterine myomata* as causes of tubal pregnancy are claimed by Buche, Bubenhofer, Frazier, Fabricius, Poorten, Wagner, and others. I have encountered this complication in 3 per cent of my cases, in two of which I can state with certainty, that the fibroids did predispose to a tubal nidation of the ovum.

*Developmental anomalies* of the tubes and the uterus are also described by many authorities as a possible cause of extrauterine pregnancy; I have had no experience with this condition, and I cannot evaluate its significance.

Analyzing critically all of the above enumerated theories of extrauterine pregnancy, which are recited perennially by many teachers, with the solemnity of a prayer, I am constrained to state, that most of them have grown hoary with the moss of tradition. It is true that in some few cases they may find ready application, but how are we to account for the vast and preponderating number of ectopies, in which neither macroscopic nor microscopic structural changes exist? Is not disease the result of functional disorders as well as of organic changes and if so, why not turn to the functional disturbances of ovular transportation and nidation for a solution of this problem?

How is the ovum transported from the fimbriated end of the fallopian tube to the uterine cavity? When we contemplate the fact that the ovum is constantly growing larger and larger from the moment it sets out on its journey, although when it reaches the isthmal portion its size diminishes somewhat, through the loss of the granulosa covering, and that the caliber of the tube is correspondingly becoming narrower and narrower the nearer it approaches the uterus, our faith in the physical possibility of the delicate hair-like projections covering the tubal epithelium, to accomplish this task, is justly shaken. A far more potent force than the one inherent in the cilia is needed to propel the ovum onward, and this force and power resides within the healthy tube wall, which manifests peristaltic properties.

Grosser has shown that soon after the ovum has entered the tube lumen peristaltic waves set in and the oviduct begins to undergo rhythmic dilatations and contractions which respectively accommodate and propel the growing ovum. This act may be compared to the peristaltic function of the gastrointestinal tract, or to the contractions and relaxations of the uterus at the time of labor.

Sellheim confirmed this view, and offered the following reasons in its support: "Wherever mucous folds are found in the body, a functional phase must be expected, and it is usually performed. And whenever a tabular organ is provided with an outer longitudinal and inner circular layer of smooth muscle fibers, it always manifests



rhythmic contractions and dilatations." The fallopian tubes fulfill these structural requisites and are hence capable of carrying out the corresponding physiologic function of peristalsis.

The many clinical observations made of late, during tubal insufflation add considerably to the correctness of Grosser's and Sellheim's dicta about tubal peristalsis. Rubin wrote, "Occasionally in a non-patent case, that is, where the pressure is high, we are ready to consider that the patient has occluded tubes, but on second examination we will find that the gas goes through." This fact must be interpreted as a spasmodic and temporary contraction of the tube. Peterson and Cron performed a laparotomy on a patient whose tubes prior to the operation were supposed to be closed, but when the insufflation was carried out under anesthesia, the gas was seen escaping from the fimbriated ends. This clinical experiment serves as a conclusive demonstration of the contractile and expansile properties of the tube and of its subordination to psychic influences. Kennedy in his studies of dysmenorrhea and sterility, also noted spasmodic contractions of the isthmial portion of the tube, which he could call forth by the injection of fluids. The peristaltic property of the tube is, therefore, no longer a mere theoretical fancy, but a definitely established physiologic fact. This phenomenon may be called forth by organic or inorganic substances finding their way into the tube lumen, or indirectly through psychic influences transmitted by the vegetative nervous system.

The ovum acting as a relatively foreign body within the tube lumen, stimulates the latter to peristaltic action, and the process of transportation is thus accomplished; the ciliated epithelium plays a very minor rôle, if any, in this function.

*What condition may interfere with the normal peristalsis of the fallopian tubes?* The proper functioning of any contractile organ depends upon a proportionate distribution of its muscular and connective tissue components, properly innervated. There are times in the life history of the generative system when the connective tissue constituent predominates, and it is considered as a normal condition. These are the prepubertal period, and the menopause. Should this developmental phase prevail during adolescence and maturity, a condition of congenital fibrosis, or as Sellheim terms it "fibromytosis" arises, which is in all probability due to an ovarian and pituitary dysfunction or hypofunction. A tubal fibrosis may also be the sequence to a preceding salpingitis, but it does not matter whether this excess of connective tissue in the tube walls is of a congenital or of an acquired origin; its effect upon the contractile and expansile properties of the tube, is the same; namely, diminution or a loss. This fibrotic state may also involve the uterus and the vagina, giving rise to sterility and dyspareunia. There are two sources contributing to, or interfering with, the function of the tube as a forwarding agent

of the ovum, (a) a congenital or an acquired fibrosis, and (b) a disturbed vegetative innervation.

*Can we influence these functional disturbances of the tube therapeutically?* The tubes with a poorly endowed musculature, or those with an acquired fibrosis, are beyond the range of our therapeutic aid; but those whose spasticity is due to psychic disorders, should be treated. Realizing that autonomic stability depends upon a proper potassium and calcium metabolism, which influences respectively the vagus and the sympathetic nerves, we ought to aim toward a restoration or maintenance of this chemical balance whenever disturbances of the vegetative system arise. The sympathicotonic individual with her genital organs in a constant or recurring state of spasticity, lacks potassium or has an excess of calcium, for the sympathetic contracts and the vagus relaxes the tubes, the uterus, and the vagina. If we can bring about an equable sympathetic and parasympathetic innervation of the genitalia by proper medication, the hypertonicity of these organs ought to be relieved. Let us hope that a proper application of this form of therapy may yield satisfactory results in some forms of infantilism and sterility, and that it may also serve as a prophylactic for ectopic pregnancy.

Visualizing the etiology of tubal pregnancy from the functional viewpoint, the hitherto unexplainable occurrence of pregnancies in tubes which macroscopically and microscopically appear to be normal, finds elucidation. To some, these newer ideas, suggestions, and hypotheses may sound fanciful, but they are spun out of tested scientific threads, and all that is necessary to complete the weaving of this fabric, is to apply these academic facts to practice.

Besides the failure of the carrier to bring the passenger to the point of destination, the passenger himself may also be responsible for his halting in byways which ultimately prove to be dangerous retreats. We know now that the site of predilection for the meeting and union of the male and female pronuclei is the fimbriated end of the tube. Under normal conditions, according to the researches of Hohne and Behne, Grosser, Sellheim, and Biedl, Peters and Hofstatter, the transtubal migration of the ovum is completed in about ten days, and after its sojourn in the uterus for four more days, placentation takes place. This prolonged passage has a purpose, it permits the host and the guest to make proper preparations for an intimate and successful meeting. Should conditions arise which hasten the process of placentation before the ovum has reached the uterine cavity, such as an increase in the local temperature, or an increase in the supply of oxygen, as was proved experimentally by Hertwig and by Holthausen, the trophoblastic blastomeres develop precipitately and any part of the genital tract may be adapted as the nidation point. An

extrauterine pregnancy may therefore also be caused by a premature ripening of the placentation properties of the ovum, before the tenth day of its travel is over.

The above survey of all the possible causes of extrauterine pregnancy leads me to their classification in the following order of importance: (a) functional disturbances of the tubal peristalsis, of a congenital, inflammatory, or psychic origin; (b) a precocious development of the properties of nidation in the ovum, and (c) mechanical or mechanopathologic causes of an intra- or extratubal nature, which are assumed to act as physical barriers to the progress of the ovum.

(3) *Is the clinical terminology "tubal abortion" correct?* The abdominal surgeon finding a gravid tube with an apparently intact surface, from whose fimbriated end blood is escaping or a blood clot protruding, terms the condition, tubal abortion. He draws this inference from his knowledge of the pathology of uterine abortion, but are the processes alike? The termination of an intrauterine pregnancy, immaterial at what period in the course of the gestation, is brought about by two invariable factors; (a) the separation of the placenta from the compacta, through rhexis in the uteroplacental area, and (b) through a contraction of the uterus, causing a disproportion in the uteroplacental surfaces, which hastens the separation and expulsion of the products of conception. In a tubal pregnancy, the chorionic villi have their roots deeply implanted within the muscularis of the tube wall, resembling to a certain extent, the chorionic invasion of the uterine wall in chorioepithelioma, or the type of placenta accreta; so that their separation from the tube wall in the uterine sense, is anatomically impossible. Nor can the products of pregnancy escape from the tubal lumen by virtue of an expulsive power, for the portion of the tube involved in the gestation area has lost its property of contractility, as proved by Martin, Prochownik and others. They escape because the capsularis, the reflexa, or whatever limiting membrane may have surrounded them, was destroyed; they fall out, or are possibly flooded out by the free blood in the tube lumen. These facts also prove the fallacy of leaving the affected tube in situ, after having squeezed out its contents, as is advocated by some, for such tubes will continue to bleed as long as the chorionic villi imbedded in their walls remain alive, and active. How are we then to interpret the bleeding from the fimbriated end of the outwardly intact pregnant tube? As stated previously the death of the ectopic ovum, is caused by the excessive intralacunar hemorrhage, which stops the placental circulation and ultimately causes a rupture of the ovular envelop, thus permitting the blood from the intervillous spaces to escape, through whatever avenue the chorionic villi have laid open. If the capsular rupture was internal, the blood will escape into the tube lumen and then into the abdomen through its fimbriated end; if

the rupture is external, i.e., if the nidation is intramural and the development proceeded centrifugally, the blood will flow directly into the peritoneal cavity, without invading the tube lumen; when the rupture is double, i.e., external and internal, the gestation products escape through both openings; and in some few instances the hemorrhage remains strictly intracapsular in type, and no free blood is found outside the gestation sac. In the face of these pathologic facts the hitherto employed terminology "tubal abortion" for the type of cases just described, as well as the designation of "unruptured tubal pregnancy" for cases which terminated without the escape of the gestation products from the tube, should be discarded. In their stead, I propose the following nomenclature for the various terminations of tubal pregnancies: (1) intracapsular rupture; (2) external rupture; (3) internal rupture; (4) a combination of 3 and 4.

4. *What is the pathologic physiology of uterine bleeding in ectopic pregnancy?* Since our social system and not the natural laws of sexual maturity dictates and determines conception, the vast number of ovulating follicles and their corresponding corpora lutea are doomed to untimely involution, and the uterine lining to the periodic sheddings associated with bleeding, termed menstruation. Due to the frequent recurrence of this phenomenon in the human female, and its comparative freedom from harm to the general health, it is looked upon as a normal function. During the premenstrual or pregravid state, and during pregnancy, this form of bleeding does not take place; because the ovule and later the ovum is alive, and the corpus luteum continues to blossom. These are fundamental principles in the physiology of pregnancy, irrespective of its location. Uterine bleeding in ectopic gestation is therefore due to the death of the ovum, and to the simultaneous suspension of the inhibitory function of the corpus luteum, which begins to involute. Novak and Darner, of the Johns Hopkins School, entertain the same views. Polak's teaching is diametrically opposite, for he states that "the vaginal bleeding in ectopic pregnancy persists as long as the ovum is alive and partially attached to its tubal bed." In support of this postulate he cites the fact that in some cases of tubal pregnancy with intra-abdominal bleeding, uterine bleeding was absent, meaning to imply that the former condition signified ovular death. These teachings are not in keeping with the more modern knowledge of the pathologic physiology of pregnancy. The intraabdominal and the uterine bleeding associated with extrauterine pregnancy are two independent processes, each having its own pathologic background. The former is purely mechanical, caused by the erosion of the tube wall, or any other maternal tissue serving as the nidation bed, by the chorionic villi; while the latter is of a functional nature, and is due to a suspension of the inhibitory forces exerted upon the uterine mucosa, by

the living ovule or ovum, and by the corpus luteum of the pregravid or gravid states. We must also be wary in interpreting intraabdominal bleeding as a sign of ovular death for it does not always signify it, as evidenced by the cases of intraabdominal pregnancy going to term, and which are always accompanied by intraperitoneal bleeding. We find an analogue to this pathologic condition in the intrauterine pregnancies which go to term, and which are associated with moderate concealed or open placental hemorrhages. Not even the clinical observation of uterine bleeding in full-term abdominal pregnancies is confirmatory of the contention that the living ovum calls it forth. It is not at all an uncommon experience in our practice to observe repeated menstrual cycles during the early months of normal intrauterine pregnancy; this is due to anomalous ovulations, and not to the viable or living embryo. This phenomenon will recur as long as the uterine cavity will remain partly open, i.e., up to the time when a complete union between the decidua reflexa and the vera takes place. In cases of abdominal pregnancy with aberrant ovulations the menstrual or pseudomenstrual phenomenon may continue throughout the entire period of the gestation, for in the latter instances, the uterine cavity does not become obliterated, due to the absence of a reflexal formation.\* Leaving out of consideration the rare and exceptional instances, we may postulate it as an invariable physiologic law, that uterine bleeding in association with extrauterine pregnancy, always indicates ovular death, and a concomitant involution of the corpus luteum of pregnancy.

The supposition made by Veit long ago, and recently revived by Polak, that the source of uterine bleeding in tubal pregnancy, particularly in the interstitial variety, is due to drainage of the intratubal contents into the cavum uteri, must also be combated, for it does not stand the light of modern physiologic and clinical knowledge. Guthmann of the Seitz Clinic, demonstrated with tubal insufflations that, at or about the menstrual period, the hyperplastic decidua occludes the uterine end of the tube to such an extent, that it becomes impervious to the passage of gas. Sellheim succeeded in overcoming this resistance by using pressure amounting to 250 mm. of mercury. It is also a well-established clinical fact that no impregnation takes place at this time or during pregnancy, on account of the extreme endometrial hyperplasia which seals the tubouterine communication; the cases of superfetation excepted. Now if neither spermatozoa, nor air can pass through this physiologic barrier, during the pregravid states, how is it plausible to expect that much coarser substances like clotted blood or trophoblast can traverse it? Further-

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\*The same phenomena may be observed in cases of uterus didelphys in which the nonpregnant half menstruated during the entire period of gestation, as I have observed in two cases.

more, we also know that the gravid tube is deprived of its peristaltic powers, so that no *vis-a-tergo* exists, and that the gestation products in themselves have no inherent motility. This theory of a reflux of tubal blood into the uterus, I am constrained to state, seems to be as purely hypothetical, as the one advanced by Sampson in relation to the regurgitation of uterine contents into the tubes during menstruation.

### III. A STATISTICAL AND CLINICAL ANALYSIS

A statistical study of my cases, and its comparison with the statistics of other clinicians, furnishes a number of interesting data for our consideration:

*Mortality.*—In my series the death rate was 0.7 per cent. My only fatality might have been avoided had drainage been instituted. This patient was ill at home for several weeks prior to her admission to the hospital with a slowly progressing intraabdominal hemorrhage secondary to a tubal pregnancy, running a febrile course. Within twenty-four hours following the operation, she became maniacal, the temperature rose to 107° F., and at the end of the twenty-eight hours, death ensued. From the postoperative course it can be inferred, that the operative trauma slight as it might have been, converted the already present infectious organisms into a most virulent type, with a fatal termination. In Engelman's statistics of thirty-seven cases of infected hematocele, the mortality reached 24.4 per cent.

*Drainage.*—Although drainage might have saved my fatal case I am nevertheless averse to it as a routine procedure, whether abdominally or vaginally. I am convinced that the intact peritoneum is far more capable of caring for the infectiousness of the free and clotted blood present in the abdominal cavity, than any form of drainage. From my own experience, and from my knowledge of the experience of others, I may state unequivocally, that drainage in extrauterine pregnancy delays convalescence, prolongs morbidity, and raises the mortality rate.

*When to operate.*—This problem still absorbs the attention of gynecologists. My answer to this query is, operate as soon as possible after the diagnosis is established. Waiting for the symptoms of shock to subside, before rendering the life-saving surgical aid, is meddlesome therapy. Clinically it is difficult to differentiate, in many cases, between shock and hemorrhage, and is not shock in ruptured tubal pregnancy due to the bleeding, and if so why not stop it at the earliest possible moment? Shock or any of its manifestations in extrauterine pregnancy never constituted an operative contraindication in my experience, and the results justify the unswerving adherence to this principle. Morphine hypodermically from a  $\frac{1}{4}$  to  $\frac{1}{2}$  grain in

actively bleeding cases is an invaluable remedy; it slows the heart action, promotes coagulation and lessens the bleeding, thus making the unavoidable preoperative delay less hazardous. Transfusion of any kind or in any form should not be resorted to until the bleeding point is under surgical control. Hawks in a review of 824 cases of extrauterine pregnancy, pointed out, that the mortality in the cases operated upon after the subsidence of the initial shock, was 17 per cent; while in those operated upon during shock and collapse, the death rate did not exceed 8.8 per cent.

*Operative conservatism.*—This note is sounded from time to time from different medical centers. Cartozolla and Dossera advocated quite recently the milking of the gestation products from the tube and leaving the latter in place. Ramsay based his proposition of conservatism on the experience of one case in which an intrauterine gestation followed such a procedure, in a patient operated upon for a successive tubal pregnancy, and had had this only tube at that time. Borell, Fink, Fränkel, Falk, Goebel, Martin, Micholitsch, Matsushima, Nuerenberger, Orthmann, and others, have preached conservatism, basing their teachings upon the fact that some cases of tubal pregnancy may go on to spontaneous healing, through the absorption of the ovum or through the conversion of the pregnancy into a mole or polypoid formation which may continue indefinitely in this state without giving rise to any untoward symptoms. No one denies the possibilities or the actual occurrence of these end-results, but they form the rare exceptions, while the majority of the tubal pregnancies go on to rupture with all its dire results. And who is clinically so astute as to be able to predict which of the two described courses an ectopic gestation will pursue? Since we have no criteria by which to foretell these eventualities, and since bleeding from a pregnant tube may go on even after the ovum has been removed or has escaped, as was shown by Fromme, and later substantiated by Aschoff, and Pankow, the conservative form of therapy should occupy an academic but not a practical place in our treatment of ectopic gestation. In this opinion share Bozemann, Frankl, Muret, Mandl, Schmidt, Sanger, Werth, and all the leading American surgeons. The only conservatism that I practice is the preservation of the corresponding ovary whenever possible.

*Prophylactic sterilization* in ectopic pregnancy is in my opinion an unwarranted procedure in the usual run of cases. The fact that the number of intrauterine gestations following ectopic pregnancy ranges from 20 to 52 per cent and that the recurrent tubal pregnancies occur in only 2.7 to 7.9 per cent, speaks against prophylactic sterilization as a routine procedure.

*Symptomatology.*—Under this heading I wish to consider only the rarer and the more recently described and rediscovered clinical phe-

nomena of ectopic gestation. Anuria occurs in some cases of ruptured extrauterine pregnancy in which the intraperitoneal bleeding is excessive. It sets in from two to twenty hours after the rupture, according to the observations of Hovart, Herzfeld, Mandelstamm, and Piskacek. That this anuria is not due to a concomitant nephritis was proved by the absence of albumin and casts, and by the negative eye findings. This urinary suppression is explained by the low blood pressure which accompanies large intraabdominal hemorrhages, hence the failure of the glomeruli to act as filters. Shoulder pains occur whenever the free blood in the peritoneal cavity finds its way to the subdiaphragmatic space, where it irritates the sensory branches of the phrenic, and from there it is transmitted to the shoulder area through the cervical branches of the fourth spinal nerve. The first observer who called the attention of the gynecologists to this symptom was Oehlecker of Hamburg, in 1913. Dewes, Herzfeld, Rubin, and Lafont, have also described this sign, within the past three years. This sign appears only when the quantity of blood in the abdominal cavity is excessive and is of value only after having excluded other conditions, such as cholelithiasis, liver abscess, adrenal tumors, and accumulations of gas or fluid from ruptured viscera, all of which may give rise to similar phenomena. Cullen's sign was described by its author in 1919 as follows: "The umbilicus itself is of a greenish hue. Above the navel is a faint bluish tinge, below the umbilicus the bluish appearance is more intense." Cullen's comment on this sign reads thus: "Whether it will prove to be of common occurrence or very rare, I cannot say, but we shall undoubtedly expect it only, when there is free blood in the abdomen, and shall be more likely to encounter it in thin individuals." Hellendal, Kapsinow, Novak, and Strube, have also observed this sign. Veit has also mentioned it and claimed that the discoloration of the umbilical area was due to a venous stasis in the tube wall brought about by their blocking with chorionic villi, and that this stasis extends to the hypogastric vessels. Other authorities claim that this discoloration is only the bluish shimmer reflected by the free blood through a very thin abdominal wall which is identical with the bluish hue, so familiar to the abdominal surgeon on reaching the peritoneal layer, in cases of intraabdominal bleeding. I have thus far not had the opportunity to observe this sign, most likely due to the fact that all my patients have had abdominal adiposities varying from the enviable to the laughable, and at times reaching a pitiable degree.

#### IV. CONCLUSIONS

1. The biomechanism of ectopic pregnancy simulates the intrauterine form in the manner of ovular nidation, in the building of a



reflexa, and in the decidual response of the extrauterine connective tissue elements.

2. The main reason for the premature termination of most ectopic pregnancies is the excessive intracapsular bleeding, due to the laying open of blood vessels in the ovular bed by the chorionic villi, which are much larger than the capillaries of the compacta in the uterus.

3. The intra- and the extratubal conditions of an organic nature are by far less responsible for the ectopic nidation of the ovum than is the disturbed peristaltic function of the tube, and the premature ripening of the placentation properties of the ovum.

4. The terminologies "unruptured tubal pregnancy" and "tubal abortion" are incorrect, for they do not express the true pathologic state. All ectopic pregnancies, even those going to term, sustain capsular ruptures of greater or lesser degrees, at some time during the gestation period. A so-called "unruptured tubal pregnancy" is in reality an "intracapsular rupture," and a "tubal abortion" is an "internal rupture" with the gestation products discharged into the tube lumen, which finally escape through the fimbriated end.

5. The point of rupture in the majority of my cases was found opposite the placentation site; this is contrary to the accepted teachings. The correctness of my observations is sustained by the following facts: (a) During the early weeks of pregnancy the chorionic villi are equipotent and they may arrose any part of the capsularies, and (b) the part of the capsularis that will yield first is the thinnest and the most stretched portion, which is usually not the placental area, for the latter always shows the greatest amount of hypertrophy and hyperplasia.

6. Uterine bleeding manifesting itself during the course of an ectopic pregnancy, indicates fetal death, and a simultaneous suspension of the inhibitory power of the corpus luteum over the endometrium, which is the only source of the uterine bleeding.

1125 MADISON AVENUE.

# THE TREATMENT OF ECLAMPSIA WITH BLOOD SERUM FROM ECLAMPTICS\*

(PRELIMINARY REPORT)

By JOHN J. McMAHON, M.D., New York, N. Y.

I BELIEVE we will all concede that our theories as to the cause of eclampsia are not clearly defined. The treatment of eclampsia is likewise unsatisfactory, as is evident from the high mortality. For a long time I have had in mind the possibility of using blood or blood serum obtained from recovered eclamptic patients for injection into acute cases.

On November 23, 1924, a colleague at St. John's Hospital, Long Island City, had a patient who was desperately ill and seemingly in the final stage of eclamptic coma. The case seemed hopeless, and, as we happened to have in the hospital on our service an eclamptic five days postpartum, who had recovered, it seemed a very opportune time to try out the theory. From November 23, 1924, to January 7, 1926, we used this serum in ten cases.

## CASE REPORTS

CASE 1, St. John's Hospital.—Mrs. S., para i, aged twenty-one years, born in U. S. Last menstruation March 3, 1924. Estimated confinement December 10, 1924. Admitted at 11:30 P.M., November 22, 1924. Temperature 103° F. Five convulsions before admission. Blood pressure 190/130. Four convulsions after admission. At 5:30 A.M., November 23, 1924, after a convulsion, she developed marked pulmonary edema, cyanosis and dilated, sluggish, divergent pupils. Patient's condition grave. Had morphine  $\frac{1}{4}$  gr. on admission; repeated once. Had hot pack and colonic irrigation. Because the fetal heart was thought to have been heard, abdominal section under oxygen was done at 8 A.M.; stillbirth, female. B. P., 5 A.M., 152/100, at noon 94/64, and when seen by me at 3 P.M., 84/80. Patient was getting oxygen with little apparent relief. Had had adrenalin minims 15, caffeine 7 gr. and atropine  $\frac{1}{150}$ . Pulse absent at radials. After blood typing at 3:45 P.M. she was given by direct transfusion 100 c.c. of blood from our recovered eclamptic. In this case the result seemed almost miraculous. The pulmonary edema seemed to begin to clear immediately and in a few hours the whole picture changed. In two hours pulse and heart had improved. Patient was conscious and took small amounts of water and nourishment. The edema had entirely disappeared within three hours. Temperature dropped in twelve hours to 98.6°.

Urinalysis: sp. gr. 1030, alkaline, heavy trace of albumin, hyaline casts.

Blood chemistry: Urea N, 13; creatinine, 1.6. Her blood and the donor's blood were Type II. On the fourth day a rise in temperature was caused by infection of the abdominal wound. Discharged on December 20, 1924.

The history of the donor was as follows: Mrs. J. S., aged twenty-four years, para

\*Read at a meeting of the Medical Society of the County of New York, February 24, 1926.

i, born in U. S. admitted November 19, 1924, in convulsions. B. P. 150. Version and extraction, stillbirth.

The urine contained a large amount of albumin with hyaline casts. The blood showed urea N, 12.2; creatinine, 2.1; and sugar, 76. On November, 24, 1924, on the fifth day, was in very good condition when blood was taken.

Encouraged by the result in this case we decided to secure serum from our next recovered eclamptic for future use. We prepared the serum in the following manner. At St. John's Hospital the blood was received in 500 c.c. Erlenmeyer flasks and kept for two hours at room temperature in slanted position, then overnight at ice box temperature. The serum was pipetted into 50 c.c. flasks and 0.25 per cent tricoresol, dissolved in about 5 c.c. of saline, added and the flask sealed. At the Misericordia Hospital it was prepared somewhat in the same manner. The blood was turned into a sterile vessel and allowed to clot, the serum decanted off and 1 per cent of phenol in normal salt solution added, equal parts of the serum to the saline, and stirred slowly. It was then sealed and kept in the ice box. A Wassermann and blood typing was also done.

CASE 2, Misericordia Hospital.—January 7, 1925. Mrs. K., para i, aged twenty-two years, born in U. S. Last menstruation April 18, 1924. Estimated confinement January 30, 1925. December 12, 1924, when last seen by physician urine was clear, no albumin. B. P. 115. January 7 when admitted to Misericordia, B. P. was 160/100 and she had had ten convulsions from 1 P.M. until 11:45 P.M. At midnight she was given 45 c.c. of serum from Type III recovered eclamptic ten days' postpartum. The serum was injected into the buttocks. The patient had one convulsion just as she received the serum and one convulsion one-half hour later. She went into labor and the head came on the perineum at 10 A.M. and was lifted off with forceps. Three loops of cord were about the neck. Baby could not be resuscitated. Fetal heart was heard at 2 A.M.

This urine boiled solid, contained many hyaline and granular casts. In thirty-six hours after injection of serum urine was practically clear, the very faintest trace of albumin being seen.

The urea N was 23; creatine, 2.2. Discharged eleventh day postpartum.

CASE 3, St. John's Hospital.—March 25, 1925. Mrs. I., para i, aged twenty-two years, born in U. S. Four convulsions before admission. Delivered of living twins. Temperature 101° F. on admission. Had five convulsions after delivery, and received 60 c.c. of serum into the gluteal region seven hours later. Had one slight convulsion twenty minutes after the injection. Had only a slight trace of albumin in her urine with no casts. The blood chemistry showed: Urea N, 12; creatinine, 1.9, and sugar, 80. She was discharged on the eleventh day postpartum with a hemoglobin of 45 per cent. Her blood and the donor's blood were Type II.

CASE 4, St. John's Hospital.—April 6, 1925. Mrs. A., para i, aged nineteen years. Admitted at 4 A.M. in convulsion with temperature of 105°. B. P. 160/120. Had seven or eight convulsions before admission and three after reaching the ward. Had marked pulmonary edema and was in grave condition at 1:30 P.M., when she was given 58 c.c. of serum into the gluteal region. Four hours later went into labor and was delivered of a stillborn child. Twelve hours after the injection of the serum the edema had disappeared. She had two convulsions after injection of serum.

The urine showed a heavy trace of albumin and hyaline and granular casts. The hemoglobin was 70 per cent. This urine on the second day was clear. Her blood was of Type II. Discharged on the tenth day postpartum.

CASE 5, St. John's Hospital.—May 10, 1925. Mrs. G., para iii, aged thirty-seven years, born in Russia. In October, 1924, had gall bladder drained for gallstones. Admitted as preeclamptic. Urine had been clear from January 12, 1925, up to May 3, 1925, and blood pressure had been 130/100 during that period. On May 3 showed a large amount of albumin and casts and B. P. rose to 180/110. Marked edema of the face and extremities. Was admitted with a severe headache. Put to bed and given the usual treatment. In ten hours she had convulsions, six in all. Delivered spontaneously, stillbirth. Marked cyanosis and pulmonary edema. Note on the chart states she expectorated large amount of foul-smelling mucus. Before delivery she was bled 500 c.c. and was in a desperate condition when given 50 c.c. of serum on May 11 at 10 A.M. She died on May 13. For twenty-four hours she seemed to be improved, had no convulsions, and on the advice of a medical consultant was given 500 c.c. of saline, intravenously. Blood was of Type II and she was given serum of Type II. This serum was inactivated. This was the only serum that we gave which had been inactivated. The records are incomplete on her blood.

CASE 6, St. John's Hospital.—May 19, 1925. Mrs. McL., para ii, aged twenty-two years, born in U. S. Admitted in convulsion at 11 P.M. B. P. 150/90. We tested this patient for a reaction by intradermal and subcutaneous injection before giving her the serum, and there was no reaction. She was given 40 c.c. of Type II serum into the buttocks after third convulsion. She was also of Type II. Temperature 100°.

The urine contained a heavy trace of albumin, sp. gr. 1028, and granular casts. Blood chemistry showed: urea N, 13; uric acid, 5.7; creatinine, 1.4; sugar, 50; and N. P. N., 25; Wassermann negative.

Made a very prompt recovery. Had no convulsions after the injection and was discharged on the ninth day after admission, as she insisted that she felt perfectly well and still felt fetal movements. We were unable to hear the fetal heart. Two weeks later she had a spontaneous delivery at home; stillbirth. She made an uneventful postpartum recovery at home.

CASE 7.—This case occurred at Lincoln Hospital, on the service of Dr. E. Davin, through whose courtesy I am reporting it. June 7, 1925. Para i, aged twenty-one years, born in U. S. Last menstruation September 10, 1924. Estimated confinement June 17, 1925. At the sixth month had pyelitis, which was supposedly cured. Urine on admission was clear, very few pus cells. B. P. 120/70. Note made after examination by neurologist,—“Vomiting and slight headache. Pupils dilated and reacted to light and accommodation. Having semiconscious periods lasting about a moment. Acts peculiar, is irrational. Cranial nerves, arms and legs normal. Reflexes normal. Attacks resemble petit mal. Mild psychosis of pregnancy rather than hysteria.”

On June 10 had a severe convulsion lasting several minutes. Pulse rapid. Unconscious. Had seven or eight severe convulsions during the day. In spite of negative urine, blood pressure and blood chemistry, a diagnosis of eclampsia was made. A spinal tapping was done, and 30 c.c. of clear fluid obtained under markedly increased pressure. Phlebotomy of 100 c.c. at 4 P.M., and at my suggestion at 4:10 P.M. 60 c.c. of serum was given intravenously. At 5:10 P.M., one hour later, 100 c.c. of serum was given intravenously. Patient had one convulsion ten minutes after serum. No further convulsions. At the time of convulsion her temperature was

104°, pulse 140. Three hours after the serum was injected, temperature 104°. Then began to drop and in twelve hours reached 99°. Patient's condition on June 11 seemed weak; resting comfortably, perspiring freely. Vomited some green fluid twice during the day. On June 12 very much improved. Temperature 98°. Mental condition normal. On June 13, macerated stillbirth. Condition of patient very good. Placenta was adherent and retained. Manual extraction. Patient put to bed in very good condition. Thirty-six hours later patient had a severe chill, rise in temperature to 103° and five days later died of sepsis, as shown by a positive blood culture showing *Streptococcus viridans* and hemolyticus.

The blood chemistry showed: Urea N, 13.9; creatinine, 1.33. Blood was of Type IV. She received serum from Type II.

CASE 8, St. John's Hospital.—July 11, 1925. Mrs. E. B., para i, aged eighteen years, born in U. S. Spontaneous delivery of living child at 5 A.M. at her home. Convulsion at 7:45 and three other convulsions before admission to the hospital. She had eleven convulsions after admission. Temperature was 106°. She was given 58 c.c. of serum in the gluteal region after thirteen convulsions and had two slight convulsions within one hour after the serum had been injected.

The urine showed a heavy trace of albumin and granular casts. The blood chemistry showed: urea N, 13.2; sugar, 110; creatinine, 1.2. Discharged July 27, cured, sixteen days after admission. Blood of Type II.

CASE 9, Misericordia Hospital.—June 24, 1925. Mrs. O. B., para i, aged twenty three years, born in U. S. Spontaneous delivery. Eleven hours later convulsions, thirteen in all. Was given 90 c.c. of serum intravenously after seven convulsions. Had six convulsions after the serum. This patient was seen in consultation when in convulsion. Discharged August 7, thirteen days postpartum.

The urine showed large amount of albumin and granular casts. Just before her convulsions she had marked edema of the extremities. This patient was Type I and received serum from Type II.

CASE 10, Misericordia Hospital.—Para i, aged seventeen years, born in U. S. Three convulsions before and thirty after delivery. Temperature 104° before serum was injected and 99° twenty-four hours later. She was given 50 c.c. of serum, about one-half of it intravenously and the remainder in the muscle of the back. Was delivered of a full-term living baby. B. P. 155/119.

The urine showed large amount of albumin, granular and hyaline casts. Twenty-four hours after serum no casts in the urine and moderate amount of albumin. The blood chemistry showed: urea N, 13; creatinine, 1.5; and sugar, 90.

No convulsions after serum was injected. The baby had many convulsions for two days similar to those of the mother and died on the sixth day.

#### SUMMARY

Ten cases: eight primipara, two multipara. Eight antepartum and two postpartum eclamptics.

Ages: One, seventeen years; eight under twenty-three years, and one thirty-seven years old.

Five living children and six stillbirths. Serum had been inactivated in one case. Three received the serum intravenously with no reaction, seemingly prompt improvement. All others received the serum intramuscularly. Smallest dose, 40 c.c. of serum; largest dose, 160 c.c. Highest temperature, 106°; lowest temperature, 100°; all patients had

some fever. Convulsions varied from four to thirty. All serum was given from Type II or IV.

One had six convulsions after serum; three had two convulsions after serum; two had one convulsion after serum; and four had no convulsions after serum.

Albumin seemed to clear very rapidly in four cases after the injection of serum.

I am reporting these cases because we were impressed by the unusually prompt and unexpectedly favorable reactions which followed the use of the serum in the majority of these cases. Two of these patients were beyond question desperately ill and apparently hopeless at the time the serum was used. We are unable to offer any satisfactory explanation for these results, but we feel and we hope that they may open up a line of experimental and clinical investigation which may bring forth something of practical value in the therapy of this disease.

I am indebted to Dr. Carl Boettiger, Director of Laboratory, St. John's Hospital, and Dr. R. Schleussner, Misericordia Hospital, for their assistance in the preparation of the serum.

148 WEST EIGHTY-EIGHTH STREET.

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## VARICOCELE OF THE BROAD LIGAMENT\*

BY WM. H. FISHER, M.D., F.A.C.S., TOLEDO, OHIO

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IN MUCH of the discussion of varicocele of the broad ligament, the old classification of two types is considered: (a) primary or idiopathic, and (b) secondary. The primary or idiopathic type is a true dilatation of the veins and not associated with any other lesions, disturbances, or growths in the pelvis. The secondary type is always concomitant with pelvic abnormalities or diseases. The incidence of type one is so rare that gynecologists of large experience covering a period of many years have not seen a single case.

As the pathogeny of the idiopathic type is disputed, it is evident that many are accepting a broad interpretation of the meaning of the word "idiopathic" and are holding to the conception of primary pelvic varix as due to congenital or developmental defects, hence its rarity. And further, where the pathognomy of varix is dependent upon lacerations, the incidence of pregnancies, displacements, and the many predisposing factors that retard the pelvic circulation, this varix is a concomitant or sequela and should be classified as type two

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\*Read before the Surgical Section of the Academy of Medicine of Toledo and Lucas County.

or secondary, but many writers still consider it as belonging to type one or idiopathic.

These idiopathic cases should be classed as pure varicocele and are to be differentiated from those where there are lesions of the adnexae and uterus, which should be classified as type two.

The occurrence of type two, however, is exceedingly common in the aggregate, and if we exclude the varix due to large growths, it still remains a clinical picture of much frequency.

A perusal of case histories reported in the literature will classify many of them as representatives of the secondary type of varix. During nearly thirty-five years of surgical work I have not had a single case of the idiopathic type. Many cases may seem so at first, but subjecting these border line ones to a final critical analysis, they fall under the heading of type two.

To elaborate this statement the following case report is of interest.

In 1902 I was called to a small town to perform a hysterectomy for a supposed cancer of the fundus. The patient, a farmer's wife, mother of a large family, age sixty, was having excessive and repeated uterine hemorrhages. Examination was negative. Pelvic organs apparently normal following the climacteric. On opening the abdomen, marked varices of both broad ligaments involving not only the ovarian but the uterine venous plexus, were noted. No other abnormalities. Panhysterectomy was performed. Patient recovered. Microscopic examination showed no malignancy.

This varix was secondary, a concomitant of many pregnancies, of various infectious diseases, and of excessive manual work, manifesting itself late owing to atrophy and circulatory changes incident to the climacteric, and now classed in the group of organic lesions of permanent dilatation.

Fothergill insists on making clear and differentiating these types and classifies varices as secondary, not only those associated with fibroids and other newgrowths and with cases of old pelvic infection, but also those where there is marked retroversion.

Therefore, if writers adhere to such differentiation, it necessarily must follow that type one, or pure varix of the broad ligament, is exceedingly rare.

The recent modern classification of this disease, due to the research work and investigations of Castano, Hertzler, and Emge, has clarified many disputed points in their entirety, not only as to pathogenesis, sequelae, and complications, but also to the proper surgical procedure.

Castano's investigations led him to assert that pure varix is due to primary organic changes in the vessel walls, the resultant of infection, principally syphilis. Hertzler remarks (1913) that in simple passive hyperemia the vessels may contract and disappear when focal lesions which called them forth subside.

These hyperemias fall into several classes. When dilatation persists, the vessels lose their power to contract and remain permanently dilated regardless of the initial lesion. The incidence of varix is more prone where general laxity of the fibrous tissue and the vessels in particular exists.

Emge (1925) continues the classification of Hertzler and others of the tem-

porary or nonsurgical type, and the permanent or surgical type. The latter is subdivided into two groups: the first, venous dilatation due to disturbed support or control of vessels without any anatomic changes in the vessel wall; the second group includes those in which anatomic changes have taken place, usually due to inflammatory lesions. He further states that "true varicoceles are practically confined to the latter division." In the first group, functional changes precede the organic changes, while in the second group organic lesions form the starting point. The first group is more common and responds to constructive surgery. The second is rarely seen and demands resection of the affected vessels.

In a recent report of 24 cases he classifies 23 as belonging in the first group and 1 in the second.

It is the purpose of this paper to refresh your minds concerning the significant diagnostic symptoms and the etiology; to present the surgical methods employed upon the varices, and above all to stress conservatism during genital life which is in keeping with our knowledge of the complications of varix and of the value of the endocrine glands.

Richet and DeValz (1860) described a case of primary uterine varicocele unrelated to any pelvic lesion.

Dudley (1888) reported four cases treated surgically, commenting on the influence of varix on the ovary and the histologic study of the excised veins.

In 1891 Petit gave an anatomic and histologic report on the ovary and varices of a sclerotic uterus removed by Pozzi.

From then on the literature is that of reported isolated cases, studies in diagnosis, pathology, symptoms, and treatment.

Castano, in 1913, began to study pelvic varicocele, since which time he has written much of great value, and advocated the "Argentine method" for radical cure.

Emge, in 1921 and 1925, reported his observations of 35 cases in his first monograph and 24 in his last, with much valuable data. He concludes that varicose veins are due in the vast majority of cases to damage of the fibroclastic suspensorium; conservative measures are usually sufficient; shortening the uterosacral and associated ligaments by special suturing and aided by round ligament transplantation; resection of veins is unnecessary unless there are varicosities due to inflammatory lesions.

In six hundred and fifty laparotomies Cotte, 1923, found seven typical cases presenting diagnostic symptoms, but with retroversion of the uterus. Ligation and excision of veins in the lumboovarian ligament with correction of retroversion resulted in cures.

#### ETIOPATHOGENESIS

Richelot described a congestive condition of the female pelvis at puberty, with well-marked clinical symptoms, that leads to a state of diffuse sclerosis and which might form the beginning of the pathologic history of pelvic varicocele.

Castano analyzed the living conditions of his patients and found unsuitable work during puberty, hard labor without adequate alimentation or proper habits, were predisposing factors, conducive to congestion, but would not cause the condition. He found these changes were the result of infection, acute rheumatism, influenza, tuberculosis, etc., but the main factor was hereditary or acquired syph-



ilis; that these specific poisons produce a venous and arterial dystrophy or sclerosis. This sclerotic tissue encircles the vein, involves the adjacent nerves and causes the neuritis of varicocele.

Richet states the venous plexus is poorly supported in the subperitoneal cellular tissue and their walls cannot withstand the blood pressure.

Auvray suggests some congenital anomaly of venous development.

Chalier and Dunet (1920) believe lesions of the ovary are a common association of and probably the primary cause of varix. In reporting a case of essential tubo-ovarian varicocele in a woman of twenty, they assert that Camuset was able to find only seven authentic case reports in the literature. In their case the uterus and right side were normal, but an enormous development of the left uteroovarian veins formed a vascular tumor. The left ovary was small and sclerocystic, and showed extensive cystic degeneration of graafian follicles, marked follicular atresia and hyperplasia of the lutein cells. They theorize that the ovary plays an important part in the pathogenesis and that the internal secretion of the ovary is the most important factor in the vascularization of the entire genital tract. In such an ovary the number of cells of internal secretion is increased and hyperfunction results.

Darnall (1917) reports thirty cases. It most often prevails in patients who have borne children, and is especially true if the perineal supports have been impaired. He believes that venous stasis is the cause of the pathologic states found in the ovary, rather than a result.

Kelsall (1921) believes varix is more frequent than supposed and assigns among other causes subinvolution of the uterus and ovarian vessels with persistence of pelvic engorgement, due to laceration of the pelvic floor; with the accompanying malposition of the uterus, torsion of the vessels is produced and the consequent obstruction to the free flow of blood causes venous dilatation.

Emge (1925), in reviewing the anatomic studies of Blaisdell on the basal ligaments of the pelvis and the perivascular tissue of Cameron, which are functionally inseparable and which maintain a variable degree of traction which in turn produce a controlling pressure on the blood vessel they ensheath, believes they not only constitute a large part of the pelvic support, but are indispensable in the control of normal venous and lymphatic pelvic circulation.

#### SYMPTOMS

The subjective manifestations of varix are varied and abundant, ranging from hysteria to melancholia. The most common complaint is continuous pelvic pain with rectal and vesical tenesmus, aggravated previous to menses and alleviated during flow. The menstrual flow is abundant and of the menorrhagic type, often merging into metrorrhagia.

Following menses, leucorrhea of the hydrorrhea type develops; congestion of the venous plexus adjacent to the clitoris produces a "permanent voluptuous sensation" at the least stimulation, not gratified, owing to dyspareunia.

The objective signs are but few and are usually of a negative character. They may be local and general.

In the local manifestations varix may be associated with a large uterus in retroflexion with edematous ovaries, painful rugosities in

the vaginal wall, which may be hot, turgid, and edematous. The varicosities may be palpated in the upright position.

The general physical signs are those of endocrine dysfunction. The congestive hypothyroid type described by Hertoghe, Levi, and Rothschild (varix of legs and labia) and of hyperovarianism and hypothyroidism.

#### SURGICAL TREATMENT

To survey and interpret a few anatomic facts in order to apply proper curative surgical technic it will be *apropos* to mention briefly the pelvic venous system.

The vaginal, hemorrhoidal, vesical, and uterine plexus drain into the inferior hypogastric veins and follow their corresponding arteries, surrounded by a dense connective tissue mixed with muscle fiber. With certain few exceptions, venous overdilatation and permanent dilatation are safeguarded by this dense perivascular tissue.

The pampiniform plexus empties through the ovarian veins into the vena cava on the right side and the renal vein at right angle on the left. They are long and tortuous, with numerous branches and are practically devoid of connective tissue and muscle support. Such anatomic development renders them susceptible to temporary and permanent dilatation; the left plexus more so, owing to the absence of a valve in the vein.

The surgical technic adopted should be guided by the pathology and type of varix presented.

Emge sums up his cases thus: damage of the fibroelastic suspensorium produces varix in the majority of cases, and proper shortening of the round and sacrouterine ligaments is productive of success. Resection of veins is indicated only where anatomic changes in the vessel wall have taken place.

In the past, I have been splitting the broad ligament posterior to the round ligament, exposing the varices, ligating with excision, and closure of the peritoneum.

This was abandoned, owing to incompleteness, distortion of tube, and sometimes hematoma of the broad ligament. In several instances it was necessary to remove the healthy tube, due to the above complications, since which time mere double ligation of vessels with linen, through the broad ligament, has been practiced with restoration of pelvic supports.

As before stated Cotte (1923) ligated and excised the veins in the lumboovarian ligament; Castano devised and published (1925) what he designates the "Argentine method," which appeals to our anatomico-surgical sense for positive results. It is simple and easy, and overcomes the mechanical cause of varicocele. He splits the peritoneum

on the ilioovarian ligament, dissects the uteroovarian venous trunk which is double, isolates, and cuts between ligatures; the peritoneum is closed with catgut.

#### COMMENTS

I maintain that, in our modern classification of pelvic varicocele, we should retain the idiopathic type or pure varicocele. As before stated, Camuset found but seven authentic cases reported in the literature. In deference to these fortunate writers and in justice to their memories as well as to clinical and surgical significance of this type, though rare, it should be a part of our classification. It clarifies this subject, it will end further disputes, and aids in the placement of varix in its proper type or group.

Castano has stated that infection plays an all important part in the causation of organic lesions of the pelvic veins from simple hyperemia to permanent organic dilatation and finds that syphilis is predominant. In our earlier cases this etiologic factor may have been present, but since our routine Wassermanns, I fail to find it a predominating factor. And when present, it has been a potent factor in the development of disturbing sequelae postoperative.

The disastrous effects of the streptococcus on the circulatory system are common clinical manifestations and I have noted, in the past few years, more cases of pelvic varix than ordinarily since the visitation of the epidemic of influenza. Permanent and satisfactory results are obtained in the pelvis, as well as other organs of the body, only when these foci of infection are completely eradicated.

The personal and clinical history of the patient is of the utmost importance in the determination of the surgical technic to be adopted. I have made it a rule that, in the presence of general infection and especially associated with menorrhagia, the shortening of ligaments and repair are supplemental to ligation or excision of veins. And further in this connection that during genital life no associated ovarian cysts that were present warranted ablation, our clinical experience coinciding with Darnall's statement that venous stasis is the cause of the pathologic states found in the ovary, rather than a result.

The preceding methods represent in the vast majority of pelvic varices the surgical technic to be adopted. There are, however, certain types of cases that warrant and need radical procedures other than those above advocated. In the first type or idiopathic, the mode of procedure should be dictated by the size of the mass, to assure success.

While I hesitate to be dictatorial, surgical judgment would indicate something more than suspension and ligation and excision in the iliac lumbar ligament.

Reasoning from analogous varix manifestations in the extremities, when resection has taken place at different levels, the occasional sequela of thrombophlebitis from effects of tubercle bacillus, spirocheta, and streptococcus, often necessitates the removal of the entire vein.

So here mere resection in the ovarian ligament could by the complication of thrombosis, infection of broad ligament veins, etc., produce an affection equally as disturbing as that for which the procedure was employed, and necessitate further laparotomy for complete excision.

As before stated, in my experience, it was necessary through accidental complications to remove in several cases the broad ligament as well as the tube, but conserving the ovary, with eminently satisfactory results, so it seems that surgical principles would dictate complete excision of the protuberant mass of veins, and in so doing the broad ligament and tube should by their close intimacy be removed *en bloc*.

In the advanced climacteric varieties there are two types that are sometimes associated with pelvic varicocoele.

The first of these is represented by permanent dilatation of veins, with laxity of supports, malpositions, and complete procidentia. Where conservation of the uterus is desirable in this variety, and where no organic lesions of the veins are present, the surgical technic in no wise should differ from the conservative methods as adopted and advanced for those in genital life.

The second variety is represented by atrophy and sclerosis of tissues, with contracture of ligaments and fixity of uterus, and associated permanent organic dilatation, of not only the tuboovarian veins, but also the uterine plexus. Here, too, are often found the rectal, vesical, labial dilatations with varix of the extremities.

I have had occasion to operate upon many of these patients who presented the pathologic picture as stated, and whose clinical picture of pelvic pain and excessive hemorrhage was uniformly present.

While I am open to conviction, I confess a timidity and have a lack of assurance as to the end-results in merely resecting the ovarian veins for this condition, and until such time as statistics will disprove this radical operation, I shall still advocate panhysterectomy for the climacteric variety.

## THE PREOPERATIVE RESPONSIBILITIES OF THE GYNECOLOGIST\*

BY WALTER T. DANNREUTHER, M.D., F.A.C.S., NEW YORK CITY  
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SINCE most pelvic operations are elective and but few emergent, the gynecologist usually has ample time for thorough preoperative study and preparation of his patients. Yet it must be conceded that not infrequently after operation the patient is disappointed by the persistence of symptoms or the surgeon distressed by an unexpected death. The prevention of these unfortunate eventualities is a problem, worthy of serious consideration. Expert anesthesia, asepsis, and the easily acquired technic have made pelvic surgery so safe that postoperative recovery can no longer be accepted as the sole criterion of success. The patient submits to operation because she is led to believe that her symptoms cannot be relieved otherwise, and that the repair of anatomic injuries or removal of diseased tissue will cure her ailments. How incumbent it becomes upon the gynecologist, then, not only to detect pathologic changes, but also to correlate cause and effect correctly, so that the purposes of the operation may be fulfilled in every respect. Even with operators of intellectual honesty and highly developed diagnostic acumen, unsatisfactory results and surgical disasters follow pelvic operations sufficiently often to justify a critical survey of the factors concerned in their causation.

The gynecologic examination of the patient is a simple matter; the examination of the gynecologic patient is a complicated procedure. The former can be accomplished in a few minutes; the latter takes time, and involves the exercise of all our diagnostic resources. The tendency to forget that the exciting cause of symptoms may be either remote or local is so great that, in the presence of frank pelvic pathology, a coexisting lesion elsewhere may not even be suspected or sought. For example, alterations in the menstrual function are not infrequently manifestations of constitutional disease, secondary anemia, neuroses, or the inherent peculiarities of the patient, as well as of endocrine imbalance, uterine neoplasms, and adnexal disease. Leucorrhea, particularly in virgins, is as likely to arise from impaired physiologic processes as from pathologic pelvic conditions. A vaginal discharge is frequently associated with anemia, and promptly cured with iron and arsenic. In several cases of leucorrhea occurring in adolescent girls, radiography of the chest disclosed the presence of

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\*Read before the New York Obstetrical Society, New York City, March 9, 1926.

an incipient pulmonary phthisis. The futility of local or operative treatment under such circumstances is obvious. Sacral backache may be due to retrodisplacements of the uterus, but it may also be an expression of focal infection, an overloaded colon tugging on its mesentery, sacroiliac strain, posterior parametritis, and numerous other etiologic abnormalities. I confess to personal embarrassment in two instances in which this type of backache continued after plastic and round ligament operations, and in which it was promptly relieved by subsequent tonsillectomy. I operated upon another patient with adherent retroflexed uterus, and was chagrined afterward to find that the backache persisted until the plantar arches were supported. Pain in one of the lower abdominal quadrants sometimes serves as the pretext for the removal of an ovary or the appendix, when the real cause of the annoyance lies in the urinary tract. In one case of this character, seen about ten years ago, the patient had been subjected to a left oophorectomy and tubal resection by another operator two years before I saw her. Since the inguinal pain had recurred, I made the mistake of operating upon her again, removing a hydrosalpinx in the stump of the left tube, and the right ovary, which had become cystic. It soon became evident that the second operation had also failed of its object, and that the exciting cause of the pain must be searched for elsewhere. A renal function test, ureteral catheterization, and pyelography demonstrated a pronounced stricture of the left ureter, which was easily cured by dilatation. I have never done an elective gynecologic operation since then without preliminary cystoscopy and an indigocarmine renal function test. In a careful analysis of 600 consecutive private case histories, it was surprising to find that 119, or 20 per cent, of gynecologic patients had some definite lesion of the urinary tract or symptoms referable to it.

From the foregoing premises, the following inferences seem justified: a liberal amount of time should be allotted to new patients; history-taking should not be delegated to office assistants; a complete physical inventory is essential; cystoscopy is an indispensable aid to the gynecologist, and a renal function test should be done before every elective operation. The further one advances in the practice of his specialty, the more serviceable are found the fundamental principles of diagnosis.

Some years ago Sir D'Arcy Power formulated the following aphorisms in describing the developmental stages in a surgeon's career: "In the first, he loses his fear of hemorrhage; in the second, he ceases to multiply operations; in the third, he acquires the moral courage to stop in the middle of an operation when he finds the condition inoperable. There is a final stage which he never acquires with the present

span of life, the ability to gauge correctly the vital resistance of the patient; yet on this depends the success of every operation." At the present time, however, we seem to be approaching the elusive fourth stage, by invoking the aid of modern laboratory procedures. Most surgical catastrophies are the result of serious constitutional or metabolic impairment, and while it is true that some patients may recover in spite of such derangements, others will surely die of them if they are not discovered and corrected. The constantly broadening field of biologic chemistry has furnished so much enlightening information that, with painstaking preoperative investigation, our prognostic facilities are tremendously enhanced. It is therefore better to devote the necessary attention to these details than to rue the oversight of them after the grave has been filled. I admit that routine laboratory examinations have been overpopularized, and that occasionally there is danger of a laboratory report superseding clinical judgment, but this is an extreme to which I have no reference. It is quite possible to become proficient in the science of medicine and still practice the art.

No general anesthetic should be administered, except in emergency cases, without an examination of the heart, and if there is marked evidence of cardiac functional disturbance, an electrocardiogram and renal function test should be done. Many operative cardiac deaths are renal deaths. Those patients who show lengthening of conduction time should be digitalized. Cases of aortic lesions and mitral stenosis are always hazardous. Good compensation of all valvular leaks is of paramount importance, and if time is necessary to secure it, time should be taken. A compromised myocardium is often the unrecognized cause of death; unrecognized because the patient does not die of cardiac failure but of embolism or pulmonary complications. In the field of obstetrics, a patient with mitral stenosis may begin her pregnancy with apparently good compensation, and subsequently develop cardiac asthma, bronchitis, or dangerous decompensation. As the intraabdominal pressure increases slowly, the symptoms progress insidiously, are easily recognized, and appropriate therapeutic measures can be instituted before the patient succumbs. On the other hand, in operative work the complications must be anticipated; the cardiac reserve fails rapidly and there is usually insufficient time to apply corrective measures before the patient expires. The simplified technic of infiltration, parasacral, and spinal anesthesia have done much to diminish the postoperative morbidity and mortality in patients with crippled hearts.

Arterial hypertension is nearly always associated with subnormal renal function. Blood pressure readings should be taken invariably, and the pulse pressure regarded as particularly significant. Patients

should be educated to submit twenty-four-hour and not casual specimens of urine for examination. If the daily renal excretion of urea is less than 300 grains, blood retention of nitrogenous waste products may be suspected. Indulgence in routine determination of the chemical elements of the blood places an unnecessary burden upon the laboratory. The patients upon whom such tests should be done are those over fifty years of age, those with hypertension, with poor renal function, with nephritis or diabetes, and those confronted with a formidable operation. Although chromocystoscopy is preferable for the diagnosis of urinary lesions other than nephritis, the phenol-sulphonephthalein test is a better indicator of the metabolic processes as represented by the kidneys. Abnormal quantities of urea nitrogen, uric acid, or creatinine in the blood should be reduced before any elective pelvic operation is undertaken. A salt free diet, with restricted protein ingestion, stimulation of the emunctories, absolute rest, etc., will do much to convert a poor risk into a good one.

Acidosis has been recognized as an entity and as a grave incident in operative cases for a long time. While it may be associated with hyperglycemia, it may also exist independently of diabetes. Not only is it necessary to detect its presence before operation, but also to fortify the patient against its advent afterward. This explains the practice of prescribing alkalis before operation and the inclusion of alkalis and glucose in postoperative treatment indiscriminately. Recently, however, the frequent occurrence and seriousness of alkalosis as a complicating factor has become appreciated, and this challenges the wisdom of such routine therapy. Acetone and diacetic acid in the urine, usually regarded as suggestive of acidosis, have been observed in the presence of alkalosis. I have also noted a high urea nitrogen of the blood concurrently with a greatly increased  $\text{CO}_2$  combining power. Distinction between acidosis and alkalosis is imperative, as the treatment of one exaggerates the other. The determination of the hydrogen-ion concentration of the blood and the  $\text{CO}_2$  combining power of the blood plasma are of immense practical value in differentiating the two. In fact, I believe that postoperative treatment can be regulated more intelligently with a knowledge of the  $\text{CO}_2$  combining power than with the estimation of any other single blood component. The essential cause of acidosis is usually an insufficient utilization of carbohydrate, because of an inadequate supply of the carbohydrates themselves or because of the inability of the body to oxidize them, so that a glucose solution given intravenously will soon compensate for the deficiency. The glucose has considerable value as a diuretic, counteracts the endogenous destruction of body proteins, and aids materially in maintaining renal function. Bicar-



bonate of soda or potassium acetate may be added to advantage. In alkalosis, the remedial measures consist of hydrochloric acid and chlorides.

I would utter a word of caution against the use of radium in the pelvis of any patient with a goiter and an increased metabolic rate. Such a patient, with a rate of plus 26, was recently referred to me for treatment of a cervical carcinoma. An application of 2000 milligram hours was promptly followed by an intense thyrotoxicosis and death in forty-eight hours. Reexamination of the blood after twenty-four hours showed an insignificant increase of the urea nitrogen from 11.9 to 14, and of the  $\text{CO}_2$  combining power from 56 to 60. The systolic blood pressure, however, rose from 150 to 208. The clinical picture was that of a patient with a toxic goiter who had been given thyroxin. While these untoward effects cannot be explained, I cannot help but feel that this unfortunate occurrence was due to something more than coincidence.

Women with a pronounced anemia are universally recognized as risky candidates for operation and are transfused beforehand. I would add my voice to that of Ward and others, in a plea for the preoperative transfusion of those with lesser degrees of anemia, especially those with impaired physiologic functions, to insure a generous supply of oxygen to all the tissues. Patients with large bleeding fibroid tumors can be treated with just enough deep x-ray therapy to control the hemorrhage, and then transfused, before hysterectomy. It is unwise to transfuse the patient first, since the irradiation has a destructive effect upon the newly introduced leucocytes, particularly the lymphocytes. On the other hand, more benefit will be derived from the transfusion if the blood leak has already been stopped. Immediate operation is then no longer urgent, and additional time may be taken to reinforce the patient's vitality in other ways.

Several cases of acute pyelitis developing during the second week of an apparently smooth convalescence have impressed upon me the advisability of giving patients who show indicanuria a series of colonic irrigations before operation. The oral administration of *Bacillus acidophilus* cultures also seems to help in the control of the toxic intestinal emanations, from which the pyelitis probably originates. Hexylresorcinol in full doses protects the upper urinary tract from bacterial invasion, and is a useful prophylactic agent in these cases.

The time at my disposal does not permit of the consideration of other important details that influence operative success. Neither has it been possible for me to present the biochemic aspects of the subject in a technical manner. As a clinician, I have learned to value and

profit by the information to be secured from the laboratory, not at the expense of surgical judgment, but correlating the one with the other. In emergency cases, the gynecologist must try to save life; in elective cases, he assumes the responsibility of relieving symptoms and conserving life, and must exercise eternal vigilance that life is not jeopardized.

580 PARK AVENUE.

(For discussion, see page 286.)

## A SUGGESTION FOR DRAINAGE IN CESAREAN SECTION .

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RECENTLY, I had an opportunity to assist in two cases of cesarean section where forceps delivery had been attempted and which were presumably infected. An infraumbilical incision was made, the uterus opened in its lower segment and closed in three layers. A cigarette drain was inserted into the pelvic cavity and the patients made very satisfactory recoveries. Both women were in extremely precarious conditions, and the blood and time saved by employing this technic made us feel that these elements were important factors in the successful outcome.

In transperitoneal section venous hemorrhage may at times prove copious and troublesome. In separating the visceral peritoneal flaps the peritoneum is undoubtedly injured, and its resistance is thereby lowered. In addition, a large raw surface teeming with lymphatics is opened to possible invasion by pathogenic germs, their toxins, or both. The majority of patients in whom transperitoneal sections are performed are usually those who have been in labor for a long time and are presumably infected. In patients of this class any technic which will save time in the performance of the operation and will conserve the patient's blood and will also provide a walled-off passage for the drainage of infected products, should prove valuable.

Drainage in connection with cesarean sections appealed to me and I have modified it for the purpose of increasing the benefits to be derived therefrom. It is believed that the initial spill does not contain the organisms responsible for peritonitis, but that peritonitis, when it does occur, is caused by pathogenic germs which invade the uterus about the fifth day and reach the peritoneum by migrating through the uterine suture lines. This latter view and the well-known facts pertaining to adhesions in the peritoneal cavity, led me to attempt the technic that I shall describe in this preliminary report. Concerning peritoneal adhesions I can best quote from Rost's book on *Pathological Physiology* (translated by Reisman): "The foreign body is such an effective stimulus to the formation of adhesions that a pus

focus will be walled off from the remainder of the abdominal cavity in twelve hours (Voleker). Indeed even such a mild irritant as a rubber or glass tube stimulates the formation of enough adhesions to prevent the evacuation of pus except from the sinus through which the drain passes."

*Technic.*—The patient is catheterized and the skin of the abdomen is prepared in the usual manner. A median infraumbilical incision is made, the peritoneum is incised, and the abdominal cavity is walled off by laparotomy pads. A hypodermic injection of  $\frac{1}{2}$  c.c. of pituitrin is given. The uterus is mesially incised in its lower segment and the baby is delivered either by podalic version, cephalically (two fingers in the mouth) or by forceps. The placenta is then delivered manually, the uterus tamponed with iodoform gauze and the incision closed in three layers, two layers of continuous chromic catgut No. 2 for the muscle and a continuous Lembert suture of No. 1 chromic catgut for the visceral peritoneum. A cigarette drain is then placed directly over the wound on the uterus and made to exit at the lower angle of the abdominal incision. The drain is held in position by looping a few interrupted plain catgut No. 0 sutures around it, the sutures passing through the subjacent anterior uterine wall. This catgut is absorbed in from twenty-four to forty-eight hours and should it for some reason be necessary to remove the drain, there would probably be no sutures hindering removal after twenty-four hours. In my two cases, I removed the drain on the sixth day after operation, but, if desired, it could have been removed with safety on the third day.

#### CASE REPORTS

CASE 1.—Mrs. A. L., thirty years of age, born in Germany, admitted to Lebanon Hospital on April 1, 1925. She had several attacks of acute articular rheumatism while in Germany and was told that she had heart disease. The history on admission states that the patient is a primipara and has been in active labor at her home for about thirty hours. Her family physician who was in attendance at this labor, had made several vaginal examinations without the use of gloves. Examination revealed a very stout, florid, female in active labor. The heart showed moderate hypertrophy, and a loud systolic murmur heard at the apex and transmitted to the left. There is also a presystolic murmur, heard at the apex accompanied by a palpable "thrill." Pulse 130. Full term pregnant uterus, vertex below and unengaged, fetal back to the left and heart heard in the left lower quadrant, 160.

Vaginal examination at the patient's home revealed the fetus in the L. O. A. position and the head unengaged, cervix four fingers' dilated, membranes ruptured, pelvis generally contracted.

On arrival at the hospital she was immediately taken to the operating room and under local anesthesia (novocaine 1 per cent) I performed a cesarean section employing the modified technic as described above. In addition I placed a small drain in the lower angle of the wound extending into the bottom of the vesicouterine space. This latter drain was removed on the third day postoperative.

Immediately after operation her hemoglobin was 75 per cent (Dare), systolic blood pressure 134. Her convalescence was satisfactory, and on the fourteenth day after operation she was discharged from the hospital. At this time the abdominal wound was healed except for a small granulating area at the lowermost angle. I have seen the patient since and her wound is entirely healed. There is no evidence of any hernia; the uterus is normal in size, position and consistency. The adnexa is normal.

CASE 2.—Mrs. M. Y., thirty years of age, admitted to Lebanon Hospital, Nov. 19, 1925. Family history is irrelevant. Patient had a laparotomy performed for uterine displacement. Does not know nature of the operation. Has one living child eight years of age and three years ago had a premature labor in the eighth month of gestation. The nature of the operative delivery employed in delivering her of this premature infant, she does not know but states that after this procedure she was "poisoned," remained in bed for six weeks, and had three blood transfusions. In the last three years she has had two miscarriages.

Patient began to have labor pains at 1 A.M. on morning of admission. She was admitted to the hospital at 10 P.M. At that time her family physician found the cervix thick and leathery and two fingers dilated. Membranes were intact. He ruptured her membranes the next day and cervical dilatation at this time was three fingers, but the cervix was still thick and leathery. The pains were weak and ineffectual. She received several doses of morphine sulphate hypodermically. She slept and appeared rested, but the cervix neither softened nor did the pains become effective. Because of the previous deliveries *per vaginam*, we decided to treat her conservatively. After three days of labor with the cervix still thick and leathery, however, the patient gradually becoming exhausted and the fetal head still unengaged, operative delivery was considered. The patient was very anxious to have a live baby and would not consent to any procedure that would risk the life of the child. Patient was operated upon under local anesthesia (1 per cent novocaine) supplemented by gas oxygen. The modified technic as outlined above was followed and in addition a small cigarette drain was inserted into the anterior culdesac. While closing the uterine incision, it was noted that the muscle in the lower one-third of the wound was exceedingly thin. The abdominal wound was closed, as is usual, in layers.

At the time of operation a culture taken from the interior of the uterine cavity contained hemolytic streptococci. Two days later a culture taken from the gauze portion of the cigarette drain overlying the uterine wound also contained hemolytic streptococci. Six days after the operation the abdominal wound at some distance from the drain broke down and cultures from this area contained hemolytic streptococci and *Staphylococcus aureus*. Drain to pelvis was removed three days after operation and uterine drain eight days after operation. On irrigating the uterine drain tract with acriflavine solution because of the presence of a purulent discharge, the irrigating fluid was noted to come out from the vagina. Vaginal examination by means of a speculum showed that this fluid was coming from the cervix, thus confirming the presence of a uterine fistula. The patient made an excellent recovery, leaving the hospital on the fourteenth day after operation, and her convalescence was fairly comfortable. Postpartum examination on Jan. 9, 1926, revealed a well-healed abdominal wound, uterus normally involuted, in normal position and freely movable. Adnexa normal.

#### SUMMARY

A preliminary report is presented of a modified technic for the performance of cesarean section in patients who are presumably infected.

Two cases are reported in which this technic was employed, in one of which cultures revealed the presence of hemolytic streptococci at the time of, and subsequent to, the operation.\*

\*NOTE: The writer has since operated by this technic on five additional presumably infected cases, with good results for both mother and child.

A uterine fistula occurred in the case showing hemolytic streptococci. Undoubtedly numbers of these organisms and infected material escaped through the hole in the uterus, but the tract formed by the uterine drain offered an avenue through which the noxious elements could escape.

Both patients recovered and postpartum examination revealed normal genital organs.

1272 GRAND CONCOURSE.

## A CLINICAL STUDY OF ONE HUNDRED AND THIRTY-THREE PREGNANCIES FOLLOWING CESAREAN SECTION\*

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THE woman who has had one pregnancy terminated by cesarean section, and again becomes pregnant, presents a very real clinical problem. With the present rather widespread tendency to resort to delivery by abdominal section on account of numerous indications, other than contracted pelvis, more and more women present themselves each year requiring a decision as to the management of subsequent pregnancies.

The fundamental question involved, of course, concerns the behavior of the uterine scar in the pregnancies following cesarean section, and whether this scar will break down as a result of the strain to which it is subjected, with the attendant disastrous consequences to mother and child. This accident has occurred on numerous occasions and one line of treatment to prevent its occurrence has been suggested, namely, that every woman who has once been delivered by cesarean section should have all subsequent pregnancies terminated in a similar manner, or as it has been tersely expressed, "once a cesarean, always a cesarean."

In this connection a number of questions naturally arise. Is such radical treatment always necessary in the treatment of subsequent pregnancies occurring in these patients? and as a corollary to this, how real is the danger of rupture of the uterine scar? and again, is it possible with the present methods at our disposal to select the patients in whom rupture of the uterine scar is particularly likely to occur?

In the hope of being able to suggest reasonably satisfactory answers to these questions, I have analyzed the results obtained in all the cases of pregnancy following cesarean section occurring in the Johns Hopkins Hospital for a period of twenty-three years, from 1902

\*Presented before the Buffalo Academy of Medicine, March 17, 1926.

to 1925. While realizing that this has been a much discussed subject, the very frequency of its discussion and the variety of views presented indicate that satisfactory answers to the questions involved have not yet been obtained. Nearly all of the reports presented up to the present time have included only comparatively small series of cases, or have represented collections of cases from various sources. It was felt, therefore, that the presentation of a fairly large series from a single clinic might prove of value in properly evaluating the questions involved. During the period covered we have had the opportunity of observing 133 pregnancies following cesarean section; these pregnancies occurring in 100 women. In the majority of instances the original operation was performed in this clinic, but in a number of them it had been done elsewhere. Included in this material are the series of 10 cases recorded by Whitridge Williams in 1917, in his study on the healing of the uterine cicatrix, as well as the series of 64 women reported by Gamble in 1922. With this increased material we are now in a position to make a more extensive clinical study of the questions involved, and to decide whether conclusions previously drawn are correct or are in need of revision.

In our entire series, 73 women were observed in a single pregnancy following the original operation, while 21 were observed in two, and 6 women in three pregnancies subsequent to cesarean section. If we now proceed to a consideration of the mode of termination of these pregnancies and the end-results obtained, a number of points of interest are encountered. I shall consider first that group in which cesarean section was repeated in the subsequent pregnancies.

A high percentage of the women in our series presented varying degrees and types of pelvic deformity, the disproportion between the size of the pelvis and the presenting part of the child giving the indication for the original operation. Where marked disproportion was again present in subsequent pregnancies, delivery by cesarean section again became the procedure of choice. It should be noted, however, that this procedure was also elected in four women with normal pelvis on account of other indications; namely, once for premature separation of the placenta, once for nephritis, and twice on account of the age of the patients. In this series, the operation was repeated once in 52 instances, while in 15 women it was repeated twice, and in 2 others three times. In these 88 operations performed on 69 patients there were three maternal deaths, a mortality of 3.4 per cent. Inquiring into the causes of death in these patients, I find that in one instance it was due to hemorrhage, in another to general peritonitis following a conservative operation done late in the second stage (operation performed twenty years ago), while in the third it was due to general peritonitis following an intestinal injury which occurred

on account of dense adhesions between the intestines and the uterine scar of the previous operation. This latter death is one which must be directly attributed to the repeated cesarean section, and the increased difficulty which may attend the procedure on account of the possible presence of dense adhesions.

The formation of adhesions following cesarean section is in our experience a very frequent occurrence, and while, as Gamble pointed out, they occur more frequently in those patients who exhibit a febrile puerperium following the operation, yet they are also encountered with an unfortunate frequency in patients who have presented a most satisfactory convalescence. Often they are of a delicate filmy nature, and give rise to no discomfort to the patient, and cause no particular difficulty at subsequent operation. A frequent type of adhesion noted was that of the single rather broad band, extending from the site of the uterine incision to the anterior abdominal wall. This particular type of adhesion probably does no great harm, but rather may serve as a suspensory ligament to the uterus. In a number of our patients it was noted at the time of their discharge from the hospital that the uterus was definitely adherent to the lower angle of the abdominal scar and yet these patients when seen some months later were found to have quite movable uteri, doubtless due to the stretching of this adherent band, a situation comparable to that observed, following the old operation of ventrosuspension.

Again, adhesions between the uterus, omentum, peritoneum, and intestines may be quite generalized and very dense. Such a condition naturally adds greatly to the difficulties of a subsequent operation, and incidentally increases its risk. Even the low cervical operation may be followed by this complication. From the above findings it may be seen that repeated cesarean section is not to be regarded as an entirely innocuous procedure.

Let us now consider the results obtained in the case of patients who were delivered by the natural passages, at or near term, following one or more cesarean sections. This group comprises 29 women, in whom 39 deliveries occurred. In addition 9 spontaneous labors occurring in this group of women were cared for elsewhere, but in the absence of accurate records they have not been included for consideration in this series.

The original operations were performed on account of various indications. In a number the operation had been done on account of disproportion in women presenting moderate degrees of pelvic contraction. In the subsequent pregnancies the children were smaller, disproportion was not present, and labor was allowed to proceed. (Brief records of the case histories of several of these patients showing points of special interest are appended.) In other patients cesa-

rean section had been performed on account of such indications as antepartum hemorrhage and eclampsia, in women presenting normal pelves. In the patients under consideration 25 pregnancies terminated spontaneously, 11 were delivered by low or mid forceps operations, and 3 by version. It is also of interest to note that 4 women in this group were each delivered three times subsequent to the cesarean section.

When the results obtained in this group are considered, we find that from the maternal standpoint they were uniformly excellent. There were no maternal deaths and no evidence of injury to the uterine scar. From these findings it is at once obvious that in this group of women repeated cesarean section was quite unnecessary from the maternal standpoint.

Considering the end-results from the standpoint of the child in this same group, we find that seven children were born dead or died within two weeks, a fetal mortality of 17.9 per cent. This would seem to be an unusually high figure, but on examining the individual records, we find that in only one instance did death occur in a full-term child, all the other deaths being in premature infants weighing less than 2400 gm. at birth. The single dead-born full-term child was delivered by low forceps after a five hour labor. Death was due to intrauterine asphyxia and may be fairly attributed to the effect of the delivery.

The proportion of premature infants in this group would appear to be unusually large, but considering the entire series they represent an incidence of 4.6 per cent. Furthermore, of these premature infants, two were born to women suffering from nephritis and one from syphilis, factors which definitely contribute to prematurity and death. It would scarcely seem justifiable, then, to draw the conclusion that cesarean section in one pregnancy predisposes to premature birth in subsequent ones.

That most serious of obstetric accidents, rupture of the uterus, occurred three times, an incidence of 2.2 per cent, which is a figure somewhat below those of Rongy and Eardley Holland, who placed the incidence of this accident at 3 per cent and 4 per cent respectively. The records of these three patients present a number of points which justify a more detailed presentation.

The first patient (Case 21 cited by Gamble) was a twenty-four-year old black multipara, with a generally contracted rachitic pelvis, diagonal conjugate 9.5 cm. Her first pregnancy ended in premature labor. At the end of her second pregnancy, a conservative cesarean section was performed in this clinic, this being followed for ten days by a febrile puerperium. In the seventh month of her third pregnancy she suddenly complained of rather severe abdominal pain. A day later, following slight vaginal bleeding, she walked to the hospital, a distance of more than half a mile. After admission, she was operated upon supposedly for a pelvic tumor complicating



pregnancy. On opening the abdomen, however, it was found that the uterus had ruptured through the previous cesarean scar, allowing the entire product of conception to escape into the abdominal cavity, where it formed a mass lying posterior to the uterus, which had been diagnosed as a pelvic tumor prior to operation. Little or no blood was found in the peritoneal cavity. Supravaginal hysterectomy was followed by an uneventful recovery. Striking features in connection with this patient were the very slight symptoms following the rupture, and the lack of bleeding and shock. Examination of the specimen revealed the fact that union following the first operation was defective, including only a bridge of decidua and peritoneum, this defective cicatrix rupturing as a result of the uterine distension. The placenta lay anteriorly.

The second patient (J. H. H., No. 12440), a twenty-two-year old white woman had a moderately contracted pelvis with a diagonal conjugate of 11 cm. Her first pregnancy had been terminated by a conservative cesarean section in another hospital. As far as could be learned the puerperium was afebrile. At the end of her present pregnancy, little or no disproportion being present, she was allowed to go into labor. After seven hours of strong pains practically no dilatation of the cervix had occurred. This fact made it apparent that the uterine cicatrix would be subjected to an undue strain if labor were allowed to continue, so abdominal section was decided upon. On opening the abdomen it was found that the scar of the previous operation was just beginning to break open, this break extending a distance of about 3 cm. in the upper angle of the old scar. A living child was delivered and the patient made an uninterrupted recovery following supravaginal hysterectomy. The placenta lay posteriorly and in the fundus.

The third patient in whom this accident (J. H. H., No. 14171) occurred was a white woman, nineteen years of age, with a normal pelvis. Her first pregnancy was terminated by cesarean section in another hospital on account of eclampsia. The course of her convalescence could not be learned. She was admitted to the hospital at the end of her second pregnancy, not in labor, but complaining of rather vague abdominal discomfort, and showing no signs of shock. Shortly after this she complained of intense shoulder pain, and after another short interval signs of internal hemorrhage made their appearance. Immediate operation revealed an extensive rupture through and beyond the scar of the previous operation, which permitted the child and placenta to escape into the abdominal cavity. Supravaginal amputation of the uterus was done, but the patient died on the third day from bronchopneumonia. Examination of the specimen showed evidence of imperfect healing following the first operation.

The symptom of shoulder pain is one which is not always present in the case of rupture of the uterus, and is a symptom which I do not recall having been mentioned as being of significance in this condition. From the work done on insufflation of the peritoneal cavity, we now appreciate the meaning of this symptom. I would, therefore, suggest that when present, it is a symptom of definite diagnostic value in the condition of ruptured uterus, particularly in those patients in whom examination is difficult or unsatisfactory.

Completing this series are three women whose pregnancies terminated in abortions. Only one of these was spontaneous; the other two being performed for therapeutic reasons. It is unnecessary to comment further on this group, although one might be justified in

noting that the incidence of abortion is apparently not increased following cesarean section. The general results are summarized in Table I.

TABLE I

RESULTS OBTAINED IN 133 PREGNANCIES FOLLOWING CESAREAN SECTION IN 100 WOMEN

MODE OF TERMINATION	NO. OF INSTANCES	PER CENT	NO. OF WOMEN	MATER-NAL DEATHS	MATER-NAL MOR-TALITY	FETAL DEATHS	FETAL MOR-TALITY
A. Repeated Cesarean section	88	66.16	69	3	3.4%	5†	5.6%
B. Delivery by natural passages	39	29.32	29	0	0	7**	17.9%
C. Rupture of the uterine scar	3	2.25	3	1	33.3%	2	66.6%
D. Abortion, spontaneous and therapeutic	3	2.25	3	0	0	—	—
Total	133		104*				

\*Apparent discrepancy due to the fact that four women fall into more than one group.

†Three deaths due to premature separation of placenta, and Nephritis.

\*\*Six premature infants.

After studying this series of pregnancies following cesarean section, it becomes evident that rupture of the uterine scar is a very definite possibility, although a rather infrequent one. Is this a preventable accident, and what rules can be formulated to guide us in the management of subsequent pregnancies? In the case of women who present marked degrees of pelvic contraction, the treatment in subsequent pregnancies is obviously to repeat the operation, but what should be done in the case of the woman in whom the original operation was performed on account of some temporary indication? If we accept the dictum that all such women should have all subsequent pregnancies terminated by repeated cesarean section, two points I think have been made fairly obvious in this series: first, that we would perform an unnecessarily large number of cesarean sections, and second, that even then we would be unable to prevent a certain percentage of ruptures from occurring. In support of this latter statement, I would direct attention to the patient in our series in whom rupture occurred during the seventh month. Moreover, Findley found in his collected series of 53 cases of ruptured uterus following cesarean section that in 20 per cent of them the rupture occurred between the seventh and the eighth and a half months of pregnancy. Nor does the low cervical operation remove the menace, as is indicated by the reports of rupture following this operation which are appearing in the literature. Consequently it would seem that the only possible way to secure 100 per cent prophylaxis would be to terminate all such pregnancies prior to the seventh month, an obviously absurd suggestion. Furthermore, we

cannot ignore the fact that added difficulty, and added risk may attend repeated cesarean section, and we cannot agree with Newell that the risk of rupture is greater than that attending the repeated operation. Expressing the situation in figures, we might say that if 100 women delivered by cesarean section on account of some temporary indication were allowed to go into labor in a subsequent pregnancy, we might expect rupture of the uterine cicatrix to occur in three instances, with one maternal death, a mortality certainly no greater than that attending the repeated cesarean section. In suggesting any rules for our guidance in the treatment of these patients, it is realized that our present knowledge is not sufficient to guide us to an accurate decision in all cases, and that in each instance the decision will have to be made after all factors in the individual case have been considered. With this in mind, the following suggestions are offered as affording a maximum of safety and prophylaxis to such patients.

1. *Patients presenting definite mechanical obstruction; such as a marked degree of pelvic contraction, who have had one pregnancy terminated by cesarean section*, should have all subsequent pregnancies terminated by the same procedure. In order to reduce to a minimum any possible danger of rupture, the accident so often occurring at the end of pregnancy or at the beginning of labor, the repeated operation should be an elective one, preferably a week or ten days before the expected date of confinement. This should apply particularly to such women as have shown evidence of infection after the original operation. Such patients should be kept under the closest possible supervision throughout their pregnancy, the rate of growth of the child and the development of uterine distension being carefully watched. It is particularly desirable that such patients should be in a hospital for two weeks prior to the expected date of confinement.

2. *In the case of patients who have had one pregnancy terminated by cesarean section on account of some temporary indication,—and such patients form an increasingly large group,—the decision as to the procedure to be followed in subsequent pregnancies is more difficult.* It would seem, however, that our safest guide at present would be to base the decision upon the character of the puerperium following the original operation. If definite evidence of infection be present, poor healing of the uterine wound is likely, with the production of a cicatrix which is poorly adapted to withstand the strain of labor, or even the distention incident to the last weeks of pregnancy. In this group, repeated cesarean section would be the procedure of choice in a subsequent pregnancy, and again this should be carried out as an elective procedure according to the suggestions laid down for the first group. A question that suggests itself in the conduct of the repeated operation in this group is the possibility of completely excising the defective scar, in the hope of obtaining a firm resistant cicatrix.

In those patients in whom the puerperium following the primary operation presented an afebrile course, one may reasonably presume, as shown by Whitridge Williams, that a satisfactory union of the uterine wound has taken place. In this group labor may be allowed to proceed, although realizing that even then an occasional rupture through the scar may take place. It seems probable that the occasional rupture occurring in this group of patients is more likely to be due to defective union following faulty suturing than to an infection giving rise to no signs or symptoms. Such factors as the age of the patient, and particularly the state of rigidity of the cervix, should also be most carefully considered in attempting to determine how much strain is likely to be thrown on the uterine cicatrix.

An incidental question that arises in the case of women with a marked degree of pelvic contraction who necessarily must have all full-term pregnancies terminated by cesarean section, is in regard to the number of times the operation should be repeated. In this connection, I might say that it has always been our custom to sterilize, at any cesarean section, those patients presenting a vital indication, whose lives would be distinctly menaced by subsequent pregnancies. In the absence of such vital indication, it has been our habit to sterilize the patient at the second operation if she so requests, provided the first child is alive and well. In the case of the patient presenting herself for the third operation, we usually advise sterilization, feeling that such a woman has fully performed her duty to society and is not justified in subjecting herself to further risks. This advice is not always accepted, and each of two women in our series have been delivered four times by cesarean section.

In conclusion, it seems fair to state that the dictum "once a cesarean, always a cesarean" does not necessarily hold true. The line of treatment to be followed in any case of pregnancy following cesarean section will have to be decided on its individual merits. The great majority of women in whom the primary operation was performed on account of some temporary indication, may be safely allowed to go into labor in subsequent pregnancies, and if those cases be excluded, which have presented a febrile puerperium after the original operation, or who present undue rigidity of the cervix, the risk will be minimal.

#### CASE HISTORIES

##### *A. Several deliveries by the natural passages after one cesarean section.*

CASE 1.—J. H. H., No. 14496, twenty-seven years old, black, generally contracted typical pelvis, diagonal conjugate 11.25 cm. First pregnancy terminated by cesarean section at another hospital; child stillborn. Second pregnancy terminated spontaneously after a twenty-three and a half hours labor; the third ended spontaneously after six and a half hours, while the fourth, attended by a midwife, also ended spon-

taneously after a short labor. In the fifth she was again treated in this clinic and again had a spontaneous labor after three and three-quarter hours.

All the children were born alive, and the three born in this clinic weighed 3,000 gm. or over. The points of particular interest lie in the number of pregnancies following the original operation, and the duration of the first labor.

CASE 2.—J. H. H., No. 13876, twenty-five years old, black, generally contracted rachitic pelvis, diagonal conjugate 10.5 cm. First pregnancy terminated by cesarean section on account of eclampsia; child stillborn. Second pregnancy terminated by low forceps after a nine and three-quarter hour labor; child weighed 3230 gm.; condition excellent. Third pregnancy terminated by podalic version at beginning of the second stage; child weighed 2620 gm; condition excellent. Fourth pregnancy ended spontaneously, a premature labor, lasting eleven and a half hours. Child small, weighing 1545 gm., but did extremely well.

CASE 3.—J. H. H. No. 11553, thirty-four years old, black, generally contracted rachitic pelvis, diagonal conjugate 10.25 cm. One ectopic pregnancy, and four early miscarriages prior to her first full-term pregnancy. First full-term pregnancy was terminated by conservative cesarean section at the onset of labor, on account of her pelvis and an associated prolapsed cord. Child weighed 3500 gm., condition excellent. The next pregnancy ended spontaneously after twenty hours, child weighing 3800 gm., condition excellent. There was no disproportion, although the child was of large size. The next two pregnancies also ended spontaneously after twelve hour labors, and resulted in living children weighing 3,000 gm. each. Four spontaneous labors after one cesarean section.

CASE 4.—J. H. H., No. 14089, twenty-five years, black, normal pelvis. First pregnancy terminated by conservative cesarean section in another city for unknown indication; a living child. Second pregnancy ended by a forceps operation by private physician; child died on third day. Third pregnancy ended in spontaneous labor in this clinic after four and a half hours. Child in excellent condition, unusually large, weighing 4630 gm. Fourth pregnancy terminated by induction of labor, on account of large child and a pregnancy apparently beyond term. After induction of labor by a bougie, spontaneous labor occurred after four and three-quarter hours, the child weighing 4065 gm. The large size of the children is of interest in this patient.

*B. Delivery by natural passages after two cesarean sections.*

CASE 5.—J. H. H., No. 14084, twenty-two years old, black. Pelvis kyphotic, oblique funnel, diagonal conjugate 11.75 cm., transverse 7.75 cm., kyphosis in upper dorsal, and also in lumbar regions. The first two pregnancies were terminated by conservative cesarean section in another city. First child alive, second died on first day. Subsequent pregnancies treated in this clinic. The third was terminated by a low forceps operation after a four-hour labor. The child weighed 2420 gm., condition excellent. The fourth pregnancy was also ended by a low forceps after four and three-quarter hours of labor. The child, weighing 2800 gm. was asphyxiated and could not be revived. The fifth was terminated in a similar manner after a nine and a half hour labor. The child weighed 3010 gm., condition excellent.

CASE 6.—J. H. H., No. 13818, twenty years old, black, generally contracted rachitic pelvis, diagonal conjugate 10.5 cm. First pregnancy terminated by conservative cesarean section on account of disproportion. Child weighed 3260 gm., condition excellent. Second pregnancy also terminated by a similar procedure; child weighed 3490 gm., condition excellent. Both operations were performed in this

clinic. In the third pregnancy no disproportion being apparent, she was allowed to go into labor. This ended spontaneously after nine hours. The child weighed 3225 gm., condition excellent.

The following case is cited as a particularly good example of a contracted pelvis in which a difference in the size of the child was responsible for the different line of treatment followed in the second pregnancy.

CASE 7.—J. II. II., No. 13552, twenty-two years, black, generally contracted rachitic pelvis, diagonal conjugate 10.25 cm. First pregnancy terminated by conservative cesarean section at the onset of labor on account of disproportion. The child weighed 2740 gm., condition excellent. In her second pregnancy, there was no disproportion present, and spontaneous birth of a living child, weighing 2360 gm. occurred after thirteen and a half hours of labor. Treatment in subsequent pregnancies would depend largely on the size of the baby. A large child would obviously have to be delivered by a repeated cesarean section; whereas in the case of a small child, spontaneous labor might again occur.

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# Department of Maternal Welfare

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CONDUCTED BY FRED L. ADAIR, M.D.

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## THE COMMITTEE ON MATERNAL HEALTH

*Organization and Plans.*—The Committee on Maternal Health, controlled by and under the direction of physicians, was organized March 9, 1923, to undertake a scientific investigation of contraception, sterilization and general problems of sterility and fertility from a medical and public health point of view. While it recognizes the importance of the ethical or moral and the economic considerations involved, the Committee aims to confine itself to the medical aspects of these questions.

The Committee's working plan has been approved by the American Gynecological Society, the New York Obstetrical Society, and the Public Relations Committee of the New York Academy of Medicine.

*Organization.*—The members of the Executive Committee who are directly responsible for the organization's activities are as follows: Doctors Samuel W. Lambert, chairman, Robert L. Dickinson, secretary, Haven Emerson, Robert T. Frank, Frederick C. Holden, George W. Kosmak, James Pedersen, and William F. Snow, Mr. Bailey B. Burritt, Mrs. Gertrude Pinchot, and Miss Marguerite A. Wales.

There are two active subcommittees: one on medical service, which is in charge of the clinical investigation outlined below—Dr. Frederick C. Holden, chairman, Dr. William E. Caldwell, and the secretary; and one in charge of research—Dr. Robert T. Frank, chairman, Dr. Herbert M. Evans of the University of California, Dr. C. R. Stockard of Cornell University, and the secretary. Dr. G. W. Kosmak serves as a committee of one to advise on publications.

As it has seemed increasingly important to attempt to determine or at least to study and discuss the medical indications for contraception and sterilization to the end that the medical profession may more fully recognize contraception as a preventive measure, the Committee is at present organizing a subcommittee on medical indications. Dr. Nellis B. Foster will be chairman of this committee, which proposes as an initial undertaking to draft and submit for medical comment and criticism a tentative list of medical indications for contraception.

There is a medical advisory group who are from time to time consulted on policies and procedures. There are also advisory, legal, nursing, and lay groups. The recently employed full-time executive secretary is a physician.

The work of the Committee has been supported by voluntary contributions. One of the Foundations has assisted with funds for research.

The office of the Committee is at 370 Seventh Avenue, New York City, in the same building with various national health organizations.

*Clinical Investigation.*—Part of the work that the Committee has undertaken is a clinical study of contraception in which the following New York Hospitals are cooperating: Lebanon, Lenox Hill, Jewish, Mt. Sinai, New York Infirmary for Women and Children, New York Nursery and Childs, Sloane, and Woman's Hospitals.

The purposes of the clinic service are: (1) to provide medical service for women needing contraceptive advice "to cure or prevent disease" as permitted under the

New York State Law; (2) to gather evidence as to indications, i. e., conditions under which advice for or against pregnancy shall be given, including application of sterilization; (3) to gather a series of histories of patients who are using various contraceptive methods under medical advice and supervision; the analysis of such histories to provide evidence as to the efficacy, harm, or harmlessness of the several methods.

The collection of such a series of case histories under the supervision of physicians in institutions of high standing is essential if the medical profession is to be able to speak with any degree of scientific accuracy about questions such as the following:

What are the physiologic and psychologic effects of contraception upon the individual?

What are the effects of contraception upon subsequent fertility?

What is the relative value of contraceptives as to reliability, simplicity, and harmlessness?

The Committee on Maternal Health through hundreds of interviews both in Europe and America has secured a great deal of valuable opinion upon those questions, but the opinions differ widely. They are therefore making an unbiased clinical investigation of the facts. They are keeping a uniform history. They have offered an honorarium to clinic physicians in order to secure complete histories. They aim to keep patients under supervision for at least a year. The method of choice where there are no contraindications is the Mensinga Pessary plus contraceptive paste. The progress in securing such case histories is slow so as to conform to the New York State Law. The clinics strictly limit their service to patients who present medical indications for contraception.

*Research.*—The Committee's three main objectives in the domain of research have direct bearing upon the problems both of sterility and fertility, namely: (1) spermatoxins; (2) when does human ovulation occur, and (3) the period of receptivity in the female.

The subcommittee on research is studying this field and has been able to promote, and in some instances to assist financially, with the study of these problems. When it is able to secure further financial assistance it proposes to increase its research activities. Needless to say in this field even more than in its clinical investigation the Committee expects no immediate or startling results.

*Other Activities.*—Some of the other activities of the Committee on Maternal Health are:

1. The abstracting and indexing of literature
2. The inspection of birth control clinics and their records
3. A critical survey of foreign experience and American practice
4. Furnishing clinics with supplies not otherwise procurable.

*Legal.*—As both our federal and state laws in differing degrees hamper physicians in giving contraceptive advice to their patients, the Committee has made some effort to secure consideration by organized medicine to the end that these laws may be amended.

The following suggested amendment has been submitted to and endorsed by the Section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association: "Resolved, that we hereby recommend the alteration of existing laws wherever necessary so that physicians may legally give contraceptive information to their patients in the regular course of practice."

Because the Postal Law forbids transmission of practical information and even medical publications concerning birth control, the following suggested amendment was submitted to and endorsed by the American Gynecological Society: "Standard



medical and scientific journals and reprints therefrom and standard medical works which contain information with reference to the preventing of conception are not nonmailable under this section."

*Conclusion.*—The Committee on Maternal Health realizes that in studying contraception they are entering a difficult field where they will meet with opposition not only from those who are biased or prejudiced but also from those who are sincerely opposed because of religious or ethical considerations. Their efforts to study sterility and fertility do not, of course, meet with these same difficulties.

The Committee, feels, however, that as every physician meets situations where he must consider contraception as a health measure, it is essential that the question be squarely faced as an important medical problem and receive proper scientific consideration.

## THE PHYSICIAN'S PART IN A PRACTICAL STATE PROGRAM OF PRENATAL CARE\*

By FRED L. ADAIR, M.D., MINNEAPOLIS, MINN.

(Chairman, Joint Committee on Maternal Welfare)

A GOOD understanding of the significance and purpose of prenatal or antepartum care must be had before an attempt is made to elaborate an intelligent and practical program and to define the relationship of the physician to such a plan for the state. The word "state" in this article refers to the geographic or governmental unit and not to the abstract definition.

According to a committee which recently drew up some standards of prenatal care for the Children's Bureau, "Prenatal care is that part of maternal care which has as its object the complete supervision of the pregnant woman in order to preserve the happiness, health, and life of the mother and child. Therefore all pregnant women should be under medical supervision during their entire pregnancy, for it is only by careful routine prenatal care that pregnancy and labor can be made safer."

If we are created to create, and the chief end of man is man, dare one in this modern era say that maternity is the chief function of woman? The carrying out of this physiologic law is vital to the perpetuation of the human race, which we assume to be the desire of human beings.

We fully realize that much can be done by caring for mother and future offspring during the period of pregnancy. We are convinced, for instance, that congenital syphilis can be more effectually treated during pregnancy than during infancy, but no one doubts that it could be still more adequately handled prior to the onset of pregnancy itself. This specific instance illustrates the general principle that while much can be done by our present plan of prenatal care to preserve the happiness, health, and lives of offspring, this plan is too limited to fully accomplish the purposes which are promulgated. While we are striving to perfect and carry out universally the care of the pregnant woman we must also begin to enlarge our conception of prenatal care, or coin another name, such as anticonceptional care or preembryonic care.

Prenatal usually implies during pregnancy, but one is led to consider when prenatal care begins, and though we may not accept the name we must recognize the fact that causes operate to affect the offspring for good or ill prior to the fertilization which leads to the ultimate development of an individual.

\*Read at the Third Annual Conference of State Directors of Maternity and Infancy Work, Washington, D. C., January 11, 1926. For complete paper, see official report.

Can we check the increase of defectives by care of the pregnant woman? Which type of prenatal care is more sane and far-reaching in its results: that which is applied to defective individuals during the antekonceptional or preembryonic period and prevents the natural increase of such individuals, or that plan which humanely surrounds these poor defectives who are prospective mothers by good prenatal care but hopelessly inadequate so far as final results are concerned?

Consider also the fact of skeletal development and the elimination of rachitis in its relation to childbearing. Can one estimate the tremendous importance of the universal elimination of this disease on childbearing and its value in preserving the happiness, health, and lives of both mother and offspring? In the same manner, the prevention of faulty nutrition, of improper hygiene (both physical and mental), and of disease would forestall many unhappy results which ensue in later life and lead to handicapped mothers and offspring.

It might seem almost useless to talk of the hackneyed subject of venereal disease,—its cure and prevention, if it were not almost an everyday occurrence to see the dire results of gonorrheal and syphilitic infection on both mothers and offspring. It is useless to think of accomplishing the purposes of prenatal care by treatment of these diseases during pregnancy. Such therapy at times cannot be avoided. The laity should understand and the medical profession realize more fully the necessity for curing these diseases prior to the onset of pregnancy and make such procedures a more general practice.

Much good could be accomplished for both parents and offspring if careful histories and physical examinations of potential fathers and mothers could be effectually made before conception took place. This would be in line with the idea of periodic physical examinations, but the viewpoint would be somewhat different. The idea back of the periodic health examination is, of course, the welfare of the individual; but here we would take into consideration not only the health of the prospective parent but also that of the future offspring. This brings us to the point of the future father and his relation to the happiness, health, and even life of both his wife and offspring. This parent has been largely ignored in prenatal plans and yet he is responsible for a great deal of damage, some of which could be avoided by the proper inclusion of this individual in the prenatal program.

We now come to a consideration of the care of the prospective mother. Proper prenatal care includes much more than the physician can supply to the future mother. Everything to make a suitable environment, assuring good hygiene, proper nutriment, appropriate work and recreation, should be provided. No physician, even granting that he has the requisite knowledge to advise properly, could furnish all the social and economic desiderata to his patients.

A very important part of any prenatal plan is the guidance of mothers in making the most of everything they have, and in case of need in assisting them to secure the necessities which they lack for themselves and the future baby. This is, of course, somewhat aside from the physician's part in the plan, but it is vital for the success of his work and for the welfare of his patients. It is highly desirable that the physician make it a point to see that some contacts are made by the patient so that these needs are met. This is, in fact, almost vital for the proper working of the prenatal plan as well as for the natal and postnatal care. The physician's main task is that of looking after the health of his clientele, but the idea of healing the sick has been so thoroughly ingrained that it is difficult to inculcate the idea of prevention into lay and medical minds. Unless one grasps the idea of prevention as applied to obstetrics there will be no comprehension of prenatal care. Unfortunately not all catastrophies can be prevented even though foreseen.

The first part the physician plays in a practical prenatal plan is his individual relationship to the prospective mother. His first effort should be to secure the con-

fidence of his patient and assure her of his interest in her welfare by a careful consideration of her problems and a study of her case.

When a patient is first seen a good history should be taken so as to bring out the past events in her life. Facts relative to her early development and nutrition should be elicited. History of previous diseases, such as scarlatina, diphtheria, rheumatic fever, tonsillitis, variola, tuberculosis, and venereal infections, should be obtained. Information as to previous vaccination is important as serious results for both mother and fetus may be prevented. Information as to the occurrence of conditions which have required surgical intervention should be secured. It is also important to obtain history of goiter, thoracic disease, and acute or chronic abdominal affections. The possibility of persistent foci of infection should not be overlooked. The sexual life of the woman should be observed from the standpoint of her puberal development and menstrual history. The character of previous pregnancies, labors, and puerperia is important, and this information may best be obtained by questions which will bring out the facts in chronologic order.

A careful physical examination should be made in order to establish the patient's status not only with reference to the pregnancy itself, but also to determine as accurately as possible the physical and mental condition of the woman. The patient must be seen repeatedly during pregnancy in order to oversee and supervise her intelligently. Final obstetric examination should be made a few weeks before the date set for confinement in order to determine the condition of the mother and the size and position of the fetus.

It is not necessary to go into details regarding the hygiene of pregnancy as the main facts are, or should be, common knowledge. Any physician should know these facts, and if he does not it is easy for him to obtain them if he is interested. It is one of his functions in some way to provide the patient with this information. He must be continually on the lookout for abnormal conditions which are both accidental and incidental to pregnancy. It is part of the physician's task to secure the cooperation of his patient so that he may be informed at the earliest possible time of any symptoms indicating complications. It is only in this manner that events which lead to disaster to mother and offspring can be avoided during pregnancy. Last, but by no means least, the prospective mother must be shown the necessity and manner of preparing herself and her home, if necessary, for the reception of the newcomer. It is only during pregnancy that proper preparations can be made for the all important natal and postnatal care.

The physician also has a relationship to his community. He is granted the privilege of medical practice by the state and as a result he incurs certain obligations. The chief one of these is teaching and helping the community to prevent disease and death among its members. It should be one of his functions to cooperate in every way with the various agencies of his community in an effort to apply prevention to the practice of obstetrics. It is his duty to educate, and demonstrate by his methods of obstetric care that he knows the importance of the proper examination and observation of pregnant women.

There is also the specialist in obstetrics and the general practitioner or inexperienced obstetrician to consider. The experienced specialist should really not care for the routine and normal obstetric cases, but reserve his energy and ability for the more trying and hazardous cases. On the other hand, the practitioner and inexperienced obstetrician should not hesitate to secure the benefit of greater experience for the welfare of their patients.

The relation of the practitioner to clinics is of great importance. Many patients cannot afford to pay an adequate fee for prenatal, natal, and postnatal care. Some cannot pay for any of this service and should receive this care in a free or part pay clinic. Other patients are able to pay for part of the service and can employ a physician for this portion of their care. There should be the fullest cooperation

between the physicians and these clinics to the ultimate benefit of all concerned. There should be helpful teamwork between those who practice obstetrics and the maternity wards of hospitals so that complicated cases can be promptly hospitalized and cared for properly before it is too late to prevent disastrous consequences. Hospital facilities for the care of maternity patients have been and are woefully inadequate. Physicians should cooperate in plans to develop and improve such hospital facilities not only in large centers of population, but, even more important, in counties and small cities.

What the individual physician should do as outlined above, the medical profession should also do on a larger scale. The community should be educated to the necessity of prevention in general and to the importance of prevention of maternal and fetal mortality and morbidity. There is nothing more important to the community than the production and protection of normal human beings. Proper obstetric care as represented by prenatal care is one of the most important ways of accomplishing this result. The medical profession should be vitally interested in fostering a state-wide plan for carrying on this work. No plan of prenatal care can be successful in any state where the participation and cooperation of the medical profession is not secured.

Teachers and teaching institutions are indispensable in the carrying out of any state plan. Those already in practice need to be taught and kept abreast of obstetric progress. Specialists must be taught and trained through years of instruction. Practitioners must be prepared during the undergraduate course and the intern year. This means good teachers who are well trained and with adequate time and energy to make teaching their main work. It means also adequate teaching hours for obstetrics, adequate equipment, and patients who can be used clinically for demonstration without harm or discomfort to themselves or offspring.

There must, therefore, be close cooperation between officials and practitioners and the medical profession. The laity and physicians must understand each other. The former must realize that careful preparation and years of study are necessary qualifications, and the latter must know that the people wish real service which gives results. Obstetric practitioners must cooperate with each other and men must realize their limitations and recognize the qualifications of others along special lines. All should strive for better institutional facilities and organizations for maternity care. There should be closer contact between practitioners and teachers and teaching institutions. Investigators should be encouraged and supplied with material for study from all available sources. We should all realize the value of statistics and especially vital statistics, and cooperate to the fullest extent in securing accurate and valuable reports. It is also important that we recognize the desirability of certain changes in reporting termination of pregnancy, especially those which result in stillbirths and nonviable fetuses. Physicians should recognize the fields of activity occupied in prenatal work by nurses and social workers. Each should take pride in his own work and respect the ability and usefulness of those in other fields of activity so that all may work together in harmony for the preservation of the happiness, health, and lives of mothers and their offspring.

# Society Transactions

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## NEW YORK OBSTETRICAL SOCIETY

MEETING OF MARCH 9, 1926

THE PRESIDENT, DR. O. PAUL HUMPHSTONE, IN THE CHAIR

### DR. ELLIOTT BISHOP described an instance of Malignancy in a Cervical Polyp.

This patient was a sixty-eight-year-old widow with the classical complaints and signs of a complete prolapse. For a month she had had a little spotting; her general condition seemed as good as one would expect at her age. The uterus, a good deal of the bladder, and some of the rectum was out of the vulva; the cervix showed a small erosion, due, we presumed, to external contact and causing the slight spotting; we also noted a small polyp that seemed innocent. Palliative treatment in the dispensary had been of slight help, and her social condition seemed to demand a return to increased efficiency; therefore she was subjected to an amputation of the cervix and an interposition of the fundus. Her recovery was uneventful.

The pathologic report read "cervical polyp with basal cell carcinoma. Chronic endocervicitis." Microscopic section of polyp showed a malignant epithelial growth which took up practically the entire section. The epithelial cells were very irregular with numerous mitotic figures. No pearl formation was seen.

Immediate consultation was held, and it was decided to apply radium in six weeks, which was done, in spite of the narrowed vagina, using 100 mg. in an inverted *T* in the cervix.

Dr. Dickinson reports that of 106 recorded cases of polyp seen in private practice, most of which had histologic examinations, but one had malignancy. Upon this patient he did a Byrne cautery amputation of the cervix, and both Dr. Archibald Murray and Dr. James Ewing pronounced one polyp malignant.

From this one case, we may presume that the malignancy is not of high degree. The patient is living and well after twelve years, though she has had a very stormy time from dysmenorrhea caused by stenosis of the canal; she was treated before the days of radium, which would have produced a menopause.

Our case interested me to study the rarity of the condition. No case has been reported in the last eight years in the *Journal of the American Medical Association* and none in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY since it was founded. In *Surgery, Gynecology, and Obstetrics*, for the last eight years we find only one reference. In the number for August, 1921, Dr. N. Sproat Heaney of Chicago reported a case and said that he had one other nine or ten years before. Dr. Vineberg of Mt. Sinai Hospital told the writer that he had seen two or three in his practice. Frank in his *Gynecological and Obstetrical Pathology*, says that "malignant changes in polypi are not very frequent, but do, however, occur. \* \* \* The association (of cancer) with uterine polypi has never been subjected to numerical study. It has been repeatedly noted in beginning carcinoma (now quoting from Mortier, writing in *Progress Medical* in 1906) that the tip of the polyp shows carcinoma, the base being still benign." Previously he states that he "has repeatedly

seen polypi erroneously diagnosed as cancer. The examination of the base of the pedicle is decisive."

While gynecologists, in general, view this condition as a rarity, gastrointestinal observers in their field take a very different stand. Erdman and Morris in *Surgery, Gynecology and Obstetrics* for April, 1925, in a survey of polyposis of the colon, said that malignancy occurred in 40 per cent of the cases. Struthers from the Mayo Clinic in the same journal for May, 1924, and, previously, in *The Annals of Surgery*, in 1920, came to the conclusion that the disease terminated in malignancy in a large percentage of cases. Doerring has been quoted by Müller that, "of fifty known cases of intestinal polyposis thirty-one terminated in cancerous degeneration." While this is extrapelvic pathology, may it not be considered a suspicious signboard? In spite of Dr. Dickinson's figures, and Dr. Graves' flat statement, may we not ask, Is this such a rarity after all? Again let us ask, If we do not find this condition has it been originally malignant, or has it become malignant? Pathologists in general believe that cancer rarely takes a polypoid form; if so, we must believe that malignancy from irritation or other cause with some degree of frequency develops on a benign polyp. Its low degree of malignancy would also incline one to the latter view.

I think, however, that the obvious conclusion is that we should view every polyp with suspicion and subject it to histologic examination, the logical treatment to follow.

#### DISCUSSION

DR. HERMANN GRAD.—I had a patient with a fibroid and also a polyp in the cervix. I did a supravaginal hysterectomy and then I did not remove the cervix. I did not suspect that this polyp was malignant. Then I removed the polyp and the pathologist reported that it was malignant.

DR. H. D. FURNISS.—I believe it would be a very simple matter to treat most of these polyps as an office procedure, because fulguration will destroy them, and it can be done without any bleeding.

Recently I also had a case of sarcomatous changes in a rather large uterine polyp.

DR. W. P. CONAWAY.—In August, 1924, I removed a cervical polyp about the size of an English walnut from a nulliparous patient thirty-eight years of age. I curetted the uterus, snipped off the polyp with a pair of scissors, and used the actual cautery on the base. The pathologist reported malignant disease. At that time we had only 25 mg. of radium available, so I used that. I explained the condition to the patient, who was a nurse, and she preferred to take her chances. Since then there has been no irregular bleeding and she has been perfectly well. That is the only case we have had in over twenty years of service.

DR. W. H. CARY.—I saw Dr. Dickinson's patient, to whom Dr. Bishop referred, only yesterday, and she is perfectly well. A very interesting feature of her course following the cautery amputation of the cervix was that she developed an atresia of the cervix, hematometra and bleeding that certainly looked very much as if she might have an extension of malignancy in the fundus. She refused diagnostic curettage and also the use of radium, which was suggested some time subsequent to the time of Dr. Dickinson's operation. By dilatation of the cervix she finally drained gradually, her periods became regular and she reached the menopause about three years ago.

DR. JOHN O. POLAK.—Some years ago it was called to my attention that there were two types of polypoid growths which might become malignant. It is surprising to find a large incidence of sarcomatous malignancy in the fibroid polyp protruding from the cervix with its origin in the body of the uterus. The mucous polyp is

an innocent affair apparently, and here, again, by routine examination, you can find more than you would ordinarily suspect. We have found four of these cases of simple mucous polyps by routine pathologic examination in the last five years.

Furthermore, I am rather of the impression, from the report that our pathologist gives us, that these growths are increased or are changes that take place in the polyp rather than originating as a malignant growth in its incipency or in its beginning.

DR. S. H. GEIST.—At Mt. Sinai Laboratory we routinely examine all specimens removed. We have had occasion histologically to study cervical polyps removed both on the Gynecological Service and the Out-Patient Department and find that very rarely indeed do these tumors present malignant changes. It must be remembered that these pedunculated growths are subjected to a great deal of trauma and that practically all of them are infected. As a result one often finds metaplastic changes in the epithelium suggestive of malignancy, and consequently an error in diagnosis may readily be made. If one recalls the report of Dr. Ewing, read by Dr. Bishop, it will be noted that in it he stated that certain characteristics were lacking to make absolutely certain the diagnosis of malignant tumor.

It is true that these metaplastic changes with their atypical cells often mislead one in a diagnosis. From our experience we must conclude that malignant change in a cervical polyp is infrequent. About two or three years ago I published the report of a number of cases of cervical polyp that were very carefully studied histologically, and in no case was there found a true carcinoma.

DR. I. C. RUBIN.—One fact that explains the relatively infrequent malignant degeneration of the cervical polypi is the common practice of removing them early, because they frequently cause spotting and bleeding and are often encountered in young women. They are snipped off in the office and that ends them. Another reason is, perhaps, the fact that these polypi may be extruded even without the knowledge of the patient or without being removed by operation.

Dr. Geist's remarks are apropos, because early epidermization of cervical polypi is a common occurrence, and on routine cutting of these cervical polypi you see very frequently large islands of metaplastic epithelium or even epidermization.

There is no doubt but that the case reported by Dr. Bishop is a genuine case of malignancy, but one must pay attention to the histologic differences.

About ten years ago I reported a case of fundal polyp, on the apex of which an adenocarcinoma had formed, which was removed by the curette. There was a great deal of discussion in that case as to whether there was not a possible mixing up of the specimens in the laboratory. There was no doubt that the carcinoma had engrafted itself upon the apex of this submucous polyp and extended down from the fundus. Malignant degeneration of a cervical polyp is, however, an exceedingly rare occurrence.

DR. JAMES N. WEST.—I have removed a great many of these polypi since 1894, and I have always regarded them as innocent growths. I do not recall ever having seen a patient who developed carcinoma after removal of one of these polypi. So if this is truly a malignant process it must be of a peculiarly benign character which is not inclined to cause metastasis or involvement of the higher structures.

DR. W. E. DANNREUTHER read by invitation a paper entitled **The Preoperative Responsibility of the Gynecologist.** (See page 260.)

#### DISCUSSION

DR. FREDERICK C. HOLDEN.—I am inclined to think that the increased operative incidence, or increase of large operative incidence, is produced by several factors, as follows:

*Ignorance.* I believe that many men proceed, not knowing many of these very important things to which the doctor has called attention. They are unable to realize the relationship existing between the pathology and the symptoms, as he pointed out, and people receive unnecessary operations, although honestly so, at the hands of men who are not able to judge the cause of the symptoms. The result is that people are operated upon and a cure is not effected. I think there are still many of us who fall into that category.

Another cause of high operative incidence is *carelessness*. We know of these things, but we do not do them. We have large services, and, as a result, we become routine and neglect many of these things that make so much for success. In so far as our service at Bellevue, which is a large one, is concerned, our operative incidence covering a period of six years is under 22 per cent, and we attribute that principally to preoperative study. We are very fortunate there in not having to hurry operations. Patients never enter in afternoon to be operated upon in the morning. We have a longer time for preoperative study, which is absolutely necessary.

DR. JAMES N. WEST.—No matter how anxious we may be to carry out thorough examination, biochemical and otherwise, patients today expect to be operated upon quickly, and they demand it. It is also very difficult to get the average patient, especially what you might call a semiprivate or ward patient in the hospital, to come in several days before and have this proper preparation. Then, again, of course, the vast majority of our cases do not demand such careful investigations. Examination much less thorough than that suggested by the doctor is sufficient to demonstrate that the patient's heart and kidneys are sound and that they are surgically competent.

I thoroughly agree with him, however, on any case which shows an incompetent surgical history. For instance, if we have a case where the function of the kidney seems to be disturbed, where the patient seems to be toxic, where she has Bright's disease, diabetes, tuberculosis, high blood pressure, or vascular disease, then I believe she should be put through a thorough examination. I had a patient the other day, a woman who weighed 230 pounds, who was extremely anemic, and who had been bleeding profusely. I found 40 per cent hemoglobin. I did a supravaginal hysterectomy for a large fibroid tumor, which was mostly submucous, and never have I had a patient make a more satisfactory recovery.

I have been surprised to find that high blood pressure is not as much of a contraindication to operation as I had believed it to be. In the last two or three years I have been forced to operate upon several patients with high blood pressure, realizing or at least feeling that they were taking a pretty big chance. They recovered satisfactorily.

DR. HARBECK HALSTED.—The late Dr. Studdiford was always tremendously interested in this subject of preoperative study. We have a rule at Sloane that no patient shall be operated upon less than forty-eight hours after admission unless an immediate operation is absolutely essential. The wait in the hospital before operation is usually nearer a week.

The two principles which we have always followed are: patients should be in the hospital at rest for at least forty-eight hours before operation, and that we should use our medical consultant in all questionable cases.

Although I am tremendously interested in cystoscopy and was very glad to hear the doctor mention its importance, I believe it is not necessary to cystoscope every gynecologic patient.

DR. DANNREUTHER (closing).—I fear that I have been misunderstood. I do not advocate that all of the diagnostic tests to which I have referred should be done



as a matter of routine. On the contrary, on my service at the Post-Graduate Hospital even a Wassermann reaction is not done routinely. I am, however, trying to educate the members of my staff to realize the importance of recognizing the clinical signs suggestive of impaired metabolism or other physical derangements, and I am relying more and more upon their discretion to determine which patients need certain tests. In the case of the dispensary patient who is to enter the ward, I have the necessary examinations made before admission to the hospital.

I do not agree with the gentleman who says that patients demand immediate operation. It is really easier to persuade those who need operation to enter the hospital after the clinic worker has established a personal contact with them, for which a week or two of palliative treatment is usually required.

I have also found that the private patient will not object to necessary diagnostic procedures if I explain that these things are done solely for her own protection.

I agree that it is not advisable to carry out any elaborate diagnostic measures without some definite indication, but if we develop our powers of observation and seize the clues which the general physical make-up of the patient very often suggests, the selection of the proper tests becomes a simple matter.

Some years ago Dr. Baldy, of Philadelphia, reported a series of 3,413 gynecologic operations in which 16 sudden postoperative deaths occurred. The most striking feature was that 13 of them occurred in 366 cases of hysterectomy for fibroid, leaving 3 in 3,047 operations for other conditions. Unfortunately, I have not been able to determine the total number of pelvic operations that I have done personally, but I know that since 1915 I have had but two sudden postoperative deaths, one of which was due to acute paralytic ileus and the other to pulmonary embolism following a thrombosis in the femoral vein.

DR. S. H. GEIST read a paper entitled: **Study of Basal Metabolism and Weight Following Bilateral Oophorectomy.** (See page 206.)

#### DISCUSSION

DR. M. A. GOLDBERGER.—The period of observation was carried out only for from three to five months postoperative, but we are continuing our studies in these cases in a special follow-up clinic, where we are studying not only operatively castrated women, but also women who have been subjected to x-ray and normal menopause. These cases are to be followed for a period of about two years and will be reported upon later.

The second important fact in our paper is that in  $\frac{1}{3}$  of our cases there is a diminution in the basal metabolism with an increase in weight. This rather coincides with most of the experimental work which has been done on animals, especially that of Murlin and Bailey.

The third fact is that the weight increase in animal experimentations might be explained by the recent work of Wang and independently by Slonaker, who showed that when albino rats were placed in activity cages there was an increase in activity every four days. This corresponds to the estral cycle of an albino rat. In the interestrus, during pregnancy, and in senility there is a marked fall, but the fall is most marked in castrated rats, being as much as 90 per cent. This may explain the increase in weight in most of the animal experimentations.

DR. HAROLD BAILEY.—It seems to me that the subject has practical import. If we are able to show changes not only in the lowered metabolism but in weight and activity as well, we should feel that there is a specific action of the ovary affecting the general metabolism of the individual.

Each of the two animals that we studied showed an increase in weight and a lowered metabolism of over 14 per cent, one being 14.2 and the other 17.6 per cent. They were animals of different size and they varied considerably in weight. If we cast out the gain in fat, which plays a negative part in metabolism, we still have one animal showing a 12 per cent and the other a 6 per cent lowering. Therefore it appears to be evident that in these two animals there was a specific reaction. It is a fact, however, that the animals became fond of us and we of them, and there is no question that following the operation they became more inactive, and it is highly probable that this inactivity and friendship between animals and man had something to do with the change in the other experiments. In other words the dogs lay more quietly throughout their detention in the metabolism apparatus. If we consider this as an important point, we must admit that we have not produced conclusive evidence of specific reaction, especially as we had only two animals. The thyroid raises the metabolism in castrated animals, and our results with the dog that had no thyroid acted as a control for the other dog. It was to be expected that the metabolism in the dog without the thyroid would suffer a considerably greater reduction, but this was not the fact; the reverse was true, for the animal with the intact thyroid suffered a diminution in its total metabolism much greater than the other.

Dr. Geist's results show, according to the figures on the charts, an increase in weight in over 50 per cent of the cases and a lowered metabolism in 62 per cent. This percentage is not high enough to term the reaction specific, but it seems to me that it shows the probability of a general change, providing that all these women were in the active sexual stage.

I cannot but feel that there is common sense back of our contention. It is expected by lay persons that a woman will gain in weight after the menopause just as it is expected that a young woman after puberty will gain the contours of a woman's figure, and, moreover, food animals are commonly castrated in order that they may gain in weight. It would have been interesting if we could have followed our animals and found that the changes were the same a year later; and likewise Dr. Geist's patients should be examined after a considerable period.

I confess that I cannot feel that this presentation depreciates the work of Loewe and Richter and others; I think it substantiates it.

DR. ROBERT T. FRANK.—The material which the doctor has presented shows the enormous amount of work involved in such a research. It has taken the co-operation of four workers to cover this field. Forty-eight cases studied in this thorough fashion are a tremendous number, and yet with this large number upon which to base his statistics, you will notice that no absolutely striking conclusions could be reached. What does that mean? If you take the lower animals, for example, the queen bee, you will find that the entire life of the female is occupied with one thing, the sexual function. If you take the rodents which Dr. Goldberger mentioned, studied in the activity cage, a tremendous difference between the sexually quiescent period and the active period brought on by estrum, is very striking; when you take Dr. Bailey's dogs, it will be noted that there is a distinct diminution of this fluctuation due to the sex cycle, and when you come to the woman the sex phase plays a comparatively minor rôle as compared with the lower species. The fluctuation, to my mind, gradually diminishes, and, therefore, if it is traced from where it is most marked as in the bee, to the higher primates, a progressive diminution of the ovarian effect, as far as these extragenital phenomena are concerned, seems to obtain. That, however, does not mean that the ovary does not play a tremendous rôle in the primate.

My suggestion would be for Dr. Bailey to interest the physiologists in the chim-

panzee and to practice on the monkey the same experiments that he had to give up in the dog.

I think Dr. Geist's conclusions that the removal of the ovary does not produce sufficiently striking symptoms to necessitate leaving it behind, if there are strong technical reasons for removing it, do apply. I think he is correct in his deduction. Possibly, if we can develop a more accurate technic of obtaining the basal metabolism, eliminating the huge technical error which must be allowed for, as normal, of 15+ to 15- per cent, his results will become more striking.

The main conclusion that is justified from this paper is that the folklore, more or less accepted by the medical profession of today, that tragic consequences must follow removal of the ovary, is greatly exaggerated.

DR. I. C. RUBIN.—I think one obstacle in the scientific study of this subject will always be the fact that we practically never castrate *per se*. In other words, the patients who were operated upon in Dr. Geist's series were operated upon either for the removal of large fibroids or double disease of the adnexa. You cannot deduct inferences from the lower animals in the human sphere for the reason that you can take out or leave at will ovaries in the dog or the rodent, and you cannot do that in the human species. So far we do not know anything with any degree of scientific certainty about metabolism following bilateral oophorectomy beyond the one point of the gain in weight, which is only a small detail. It is perfectly natural for women to bleed a good deal from fibroids and disease of the adnexa for the relief of which operative removal of the genitals becomes imperative. The ovaries in Dr. Geist's series were incidentally removed with the uterus. The relief from the drain entailed for months by the blood loss itself is followed by a gain in weight without necessarily ascribing this increase in weight to the fact that the ovaries had been removed. This and a certain possible psychic relief that comes from the knowledge of being rid of disease are factors that cannot be translated from the lower animals to the highest primates.

We also do not know whether or not the uterus *per se* has any effect upon metabolism and you will have to have a series of control cases, for example where the uterus is left *in situ* and check them up with all the painstaking detail that Dr. Geist and Dr. Goldberger have done in their present report.

While the effort is absolutely a worthy and creditable one, we shall always have this difficulty to deal with in working upon the matter of basal metabolism following hysterectomy in contradistinction to animal castration.

Dr. J. A. CORSCADEN.—We have brought about radium castration, so-called, that is, cessation of menstruation with the appearance of hot flashes, which seems to be the criterion of the established menopause, in some 200 women, in whom there was an average gain in weight of 8 pounds. I think Dr. Rubin's stressing of the point that the fact that these women were diseased is important. Unfortunately, we have not controlled our cases with a lot of other similarly severe operations. It is very difficult to get general surgical conditions to compare exactly with these operations in the pelvis which require excision, but as far as superficial results go there is just about as much gain in weight in women operated upon for other conditions which do not involve the removal of the ovaries.

The second point is that in our studies of basal metabolism we have 11 women who have gone two years and in these the basal metabolism figures have persisted. We have two cases which are interesting. One is a woman who was made amenorrhoeic by radium when the basal metabolism was -17, and it has persisted at that point; it has not varied above or below during the two years. The other case was one of exophthalmic goiter, whose bad condition demanded the amenorrhoea. Her basal metabolism was 20+ and still persists at the end of about two years.

DR. GEIST (closing).—One fact is certain; there is a gain in weight and a diminution in basal metabolism following castration. Whether or not the castration as an operative procedure causes these changes or whether some disturbance resulting from the removal of the ovaries does it, I cannot at the present time state.

To answer Dr. Rubin's query concerning the removal of the ovaries and the question of preexisting disease having an influence; we can state that we are now studying the same factors in women in whom the menopause is normal, where the effect of disease and the removal of the ovaries does not enter into the question. Possibly at a later date we shall be able to clear up this particular phase.

As to the question raised relative to a gain in weight because of the removal of diseased organs, it is interesting to note that in six of these women the weight was between 190 and 210 pounds, that they were suffering from local conditions, and did not present any general disease. One could readily conclude, therefore, that no general debilitated condition caused a change in their weight and basal metabolism.

It would be important if some one would undertake the same study on general surgical cases to see what effect the removal of the gall bladder, kidney, etc., would have upon the subsequent course of basal metabolism or weight. Dr. Corseaden mentioned the fact that he had a case whose basal metabolism remained at -17 and varied very little after castration. We too have had a number of similar cases that showed, following castration, no change at all. It must be remembered, however, that in a large number there was a tendency toward diminution in basal metabolic rate. As I mentioned at the outset of the discussion, whether these variations are due to some extraneous factors or to defects in our clinical methods of investigation, as Dr. Frank also mentioned, is a question which, at the present time, cannot be answered definitely. There is a possibility that they are simply accidental findings and, on the other hand, we have been unable to prove that the results may not be due to some functional change which results when the ovaries have been removed.

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## BROOKLYN GYNECOLOGICAL SOCIETY

STATED MEETING, MARCH, 1926

DR. WM. P. GRAVES, of Boston, read, by invitation, a paper entitled,  
**Problems of Organ Conservation in Pelvic Surgery.** (See page 217.)

### DISCUSSION

DR. JOHN O. POLAK.—I wish to state that on the question of supracervical *versus* total hysterectomy, I have modified my views. I have been doing total hysterectomies for a number of years and have perfected a technic that is very satisfactory, but I am free to say that supracervical hysterectomies are very much more easily and quickly performed and my patients make a smoother convalescence, although the mortality is very little different in the two types of operation. I now do complete hysterectomies only in those cases where there is extensive disease of the cervix, complicating the pathology of the uterus for which the operation is done. I am forced to conclude that my mortalities and morbidities are slightly lower than they were when I was so enthusiastic about panhysterectomies.

That cervical cancer is a definite entity and does occur in the retained stump, Dr. Graves admits, but I am now taking care of the cervix prior to operation, with the cautery and tracheloplasty, depending on the microscope for subsequent treatment.

With radium we have a method of treatment for these cervixes that are left. In suspicious cases we can absolutely eliminate the occurrence of cancer by using radium on the stump.

The question of conservation of the uterus and of the ovaries in various types of pelvic disease is indeed controvertible, and in this I disagree with Dr. Graves, as I find that the woman's psychic life is taken up with two thoughts: will I menstruate? and if I do not, why not? In other words she is spending her life in expectancy and disappointment and that is what unstabilizes our women. I feel that if we are going to do conservative pelvic surgery we should try to preserve the menstrual function. This is indeed most necessary in young women, where an ovary can be conserved. On the other hand, if the ovaries have to be removed then I believe that it is better to remove everything. In the conservation of ovaries, etc., in young women, affected by extensive inflammatory disease, where conservative surgery is practiced, further operative procedure may have to be undertaken.

# Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

## Collective Review

### New Books

By ROBERT T. FRANK, A.M., M.D., F.A.C.S., NEW YORK CITY

OF GENERAL interest to the medical profession are two quite dissimilar volumes, the first a purely objective exposition dealing with the physiology of sex, the second a highly speculative structure which treats of the origin of life.

In many ways Marshall's short *Introduction to Sexual Physiology*<sup>1</sup> is more satisfactory than its larger predecessor *Physiology of Reproduction*. This is, perhaps, due to the fact that the necessity for compression has forced Marshall to feature his own opinions to a greater extent. The book is meant especially for the student of biology, medicine and agriculture, but really carries a far wider appeal. The addition of such subjects as abortion, rate of propagation and birth rate in man is commendable, as also is the discussion of such fanciful topics as *Zemā* and maternal impressions, if only to lay their ghost.

In my opinion the rapid advance of our knowledge of the causes of sex phenomena will soon permit far greater simplification in the discussion of the forces at work, and of the chemical basis of sex. Marshall is fully justified, however, while writing such a guide, to incorporate only the fully accepted and worked-out phases of the subject and to leave the most recent acquirements for a future revision.

No pathologist will agree with Marshall that "When the tissue denudation (of the uterine mucosa) is exceptionally great the condition is known as menorrhagia \* \* \*" (p. 52). The explanation of excessive menstrual bleeding is not quite so simple as that! The modern students of sex physiology are more and more abandoning the view that the normal nutritional condition of the uterus is influenced largely by the interstitial cells, though Marshall appears somewhat hazy in his analysis of nidation. He recognizes on the one hand that the corpus luteum prepares the uterine mucosa for reception of the ovum, but does not appreciate that Leo Loeb's work on artificial "deciduomata" or "placentomata" (which he mentions) demonstrates that nidation (certainly among rodents) is dependent upon that special function of the yellow body which governs the formation of the maternal part of the placenta. That the corpus luteum can be dispensed with early in pregnancy is fully explained by the vicarious action of the chorion and placenta.

Marshall's book is to be recommended highly to all medical men.

George W. Crile,<sup>2</sup> together with Amy F. Rowland, has put into book form the conclusions to which his various studies in different fields, but all directed toward the same end, have led him. Summed

<sup>1</sup>An *Introduction to Sexual Physiology*. For Biological, Medical and Agricultural Students. By F. H. A. Marshall, F. R. S., Longmans, Green, and Co., London, 1925.

<sup>2</sup>A *Bipolar Theory of Living Processes*. By George W. Crile, Edited by Amy F. Rowland, Macmillan Co., New York, 1926.

up, the author believes that all life is ascribable to a bipolar condition. Starting with the atom and ending with man as the highest primate, he tries to prove the uniformity of the bipolar pattern. To use the author's own words, "The purpose of this thesis has been to present certain evidence and deductions based upon that evidence in support of the theory that man and animals are bipolar mechanisms and that the organism not only is driven by electricity, but that it was originally created and constructed by electrical forces."

In substantiation of this highly interesting and speculative hypothesis, Crile draws all the evidence adducible from his own many researches and from those in the literature. It will take the work of many physiologists, both critical and constructive, to prove or disprove the tremendous amount of material, not all of which has hitherto been accepted by physiologists, in order to arrive at a more final conclusion.

#### GYNECOLOGY

The excellent impression made by the first edition of Schröder's *Textbook of Gynecology*<sup>3</sup> (reviewed in 1923) is fully confirmed by the present second edition in which the general form of the first edition has been retained, but numerous improvements have been made. Especially commendable are the added colored illustrations of microscopic specimens. The criticism, made in the previous edition, that Schröder had entirely overlooked the American literature no longer applies, as the author has made a serious attempt to credit American authors for the work done in the last years. The book shows such originality in dealing with modern problems of gynecology that a translation into the English language would be fully warranted, as we have no English textbook which gives as conservative and modern an exposition as this one.

Not less than seven large installments of Halban and Seitz's *Biology and Pathology of the Female*<sup>4</sup> have arrived since the last review. These include installment 18 to 24 and cover an enormous amount of ground. Installment 18 deals with the *normal and pathologic conditions of the placenta and the amniotic fluid* by Hans Hinselmann. This work is particularly striking because of the profuseness and excellence of the illustrations. The literary references are most difficult to examine as many of them are not even alphabetically arranged and, as in the rest of this series, are far from complete. H. R. Schmidt has dealt with the *pathology of the decidua, the membranes and the cord*.

Installment 19 contains the *physical chemistry of pregnancy, labor and the puerperium* (H. Schade). He describes such changes as occur because of the presence within the uterus of a new focus of intense metabolism, comparable in some way to the metabolic changes resulting from inflammation.

The *physiology of pregnancy* is taken up by E. Kehr. He believes that ovulation does not occur during pregnancy. He recognizes the paramount importance of the corpus luteum during gestation but has not incorporated the newest discoveries in his discussion. The blood and metabolic changes of pregnancy are satisfactorily discussed.

In installment 20 Eufinger has been assigned the chapter on the *diag-*

<sup>3</sup>*Lehrbuch der Gynaekologie fuer Studierende und Aerzte.* By Dr. Med. Robert Schröder, Verlag von F. C. W. Vogel, Leipzig, 1926.

<sup>4</sup>*Biologie und Pathologie des Weibes.* By Prof. Josef Halban, Wien, und Prof. Ludwig Seitz, Frankfurt, a.M. Lieferung 18, 19, 20, 21, 22, 23, 24, Urban and Schwarzenberg, Berlin, 1925.

*nosis of pregnancy.* Guggisberg devotes more than 200 pages to labor pains. I note that no mention of Dixon's theory of the initiation of labor through pituitary hypersecretion is mentioned, although many of the other theories have received comment. Pathologic contractions are discussed in great detail.

Installment 21 by A. Mayer covers the subject of the *clinical aspects of ovarian tumors* in a satisfactory fashion. An enormous bibliography covering 60 full pages of close print concludes this chapter, but, unless the reader wades through this tremendous material, author by author, the references to the literature are of no particular value. In the same installment Fütth has described *injuries and foreign bodies in the genital tract*. Included in his exposition are the injuries resulting from childbirth.

Installment 22 contains the *diseases of the peritoneum* by Karl Baisch. He believes that well developed, diffuse bacterial peritonitis is a strictly surgical disease, recommending median incision, evacuation of the pus, followed by irrigation, wiping out of the purulent exudate, counter incision, and tube drainage. If the cause can be dealt with readily, he advises that this be done. I find no new statistics available. The author takes no very decided stand on the treatment of tuberculous peritonitis, describing impartially surgical, medical and roentgenologic therapy.

To v. Jaschke has been assigned the discussion of the *female breast*.

Installments 23 and 24 contain *operative obstetrics* from the pen of that dean of gynecology, Winter of Königsberg. Before dealing with the operative technic, the author discusses most thoroughly the indications for interruption of pregnancy or the induction of labor. He employs a tongue-shaped incision on the cervix and anterior vaginal wall as the first step in anterior vaginal hysterotomy. He has given up entirely the use of the Bossi dilator in favor of more surgical methods. According to him, vaginal cesarean section is the sovereign method of dilatation. His stand on episiotomy is conservative. This procedure should not be considered the typical method of preserving the perineum. He limits the applicability of hebosteotomy to multiparae. The *Kielland forceps* is discussed by Dr. Karl Fink as a subsidiary portion of this chapter. He considers the new forceps as a valuable instrument, particularly with a head high up in the pelvis but believes that it requires large obstetric experience to distinguish the cases in which this instrument is particularly indicated. In lower positions of the head, the Kielland forceps offers no advantage over the standard methods.

As regards cesarean section, the classical cesarean, as well as the transperitoneal method of Doederlein and Krönig, are emphasized. The flap operations current in this country are merely mentioned. On the whole, this exposition of operative obstetrics is most satisfactory.

#### OBSTETRICS

Ehrenfest has given us an American edition of *The Therapy of Puerperal Fever*,<sup>5</sup> written by Robert Koehler. This is the first work dealing specifically with puerperal infections that has been available to the English speaking physician for many years. The work covers

<sup>5</sup>*Therapy of Puerperal Fever.* By Dr. Robert Koehler, Vienna. American Edition prepared by Dr. Hugo Ehrenfest, St. Louis, The C. V. Mosby Co., St. Louis, 1925.



the entire field most thoroughly, beginning with protection of the patient before and during labor and deals with prophylactic immunization, which the authors agree is not feasible for general application.

Part II is devoted to therapy. The respective chapters are divided into *General Therapy*, *Local Therapy*, *Surgical Therapy*, *Medicinal Treatment of General Infection*, and *Chemotherapy*. The entire literature is gone into in considerable detail. On the whole, like all others, the authors find our efforts to combat the infection by radical means most unsatisfactory. This applies to surgical treatment, including ligation of the veins, as well as to chemotherapy (foreign protein, dyes).

This book is recommended to the entire profession as a valuable and entirely unbiased presentation of what we know of the subject. This is quite in contrast to the next volume to be discussed.

Geddes<sup>6</sup> has given us a biased exposition of *Puerperal Septicemia: Its Causation, Symptoms, Prevention and Treatment* in a book which received the Nicholls prize in 1924 from the Royal Society of Medicine. This rather voluminous monograph boils down to the following (after one has waded through literature of bacteriology, etiology, and influence of climate and other conditions): that industrial accidents determine the puerperal fever rate in every district because such accidents invariably cause septic wounds. The resulting septic wounds become sources of infection to women in labor through the agency of the medical practitioners, because these latter cannot avoid being contaminated by such wounds in their daily practice. Nothing in the tedious mass of statistics, through which I found it necessary to wade, throws any new light upon the subject. The author's desire to have obstetric cases attended by qualified specialists in proper hospital environment is naturally devoutly to be sought for irrespective as to whether we accept his deductions or not.

Dorland and Hubeny<sup>7</sup> have published an *atlas of x-ray in embryology and obstetrics*. This compilation covers the x-ray findings on both the fetus and the adult and therefore the title is somewhat misleading.

The biologic effect of the x-ray is thoroughly detailed. Injury to the fetus in utero, due to raying, is fully reviewed. The authors mention that the bone centers, as demonstrated by clearing oils, and those shown by the x-ray do not correspond; that ossification is more rapid in the female; and that the first site of ossification demonstrable is in the region of the incisor tooth of the inferior maxilla, which can be demonstrated at the seventh week. Anomalies of skeletal development are fully discussed. Visceral anomalies, especially displacements, as seen in the newborn, are of interest. A large part of the volume is devoted to x-ray of the female pelvis and its employment in determining bony contracture. The concluding portion of the book deals with teratologic radiography. A large bibliography concludes each chapter. Numerous plates illustrate the text.

*Modern Views on the Toxemias of Pregnancy* by de Wesselow and Wyatt<sup>8</sup> appears in the *Modern Medical Monographs* edited by Hugh

<sup>6</sup>*Puerperal Septicemia: Its Causation, Symptoms, Prevention and Treatment.* By George Geddes, M.D., C.M., Wm. Wood and Co., New York, 1925.

<sup>7</sup>*The X-Ray in Embryology and Obstetrics.* By Dr. W. A. Newman Dorland and Dr. M. J. Hubeny, Bruce Publishing Co., St. Paul, Minn., 1926.

<sup>8</sup>*Modern Views on the Toxemias of Pregnancy.* By O. L. V. de Wesselow and J. M. Wyatt, Paul B. Hoeber, Inc., New York, 1925.

*Maclean*. Although the views expressed are modern, the book itself was written before June, 1923, not appearing in print until 1925. Like others of the series, it is intended for the general practitioner. To be commended is the emphasizing of Stroganoff's treatment of eclampsia which, it is hoped, will more and more replace the radical procedures, except in very rare and selected cases.

Bourne in his *Recent Advances in Obstetrics and Gynecology*<sup>9</sup> tries to record the trends of opinion and movements of thought which have really affected medical practice for some time. The large field can naturally be covered only in a fragmentary way, but the author has shown good judgment in concentrating upon important problems and in giving them adequate discussion.

He emphasizes the fact that the tendency in the treatment of eclampsia is more and more toward conservative measures, the Stroganoff method or some modification of it being most in favor. He mentions a treatment for placenta previa, devised by Willet, in which a traction clamp connected with a weight attached to the bed is applied to the fetal scalp, thus not only hastening labor, but producing continuous pressure on the placenta.

Bourne speaks most glowingly of Fothergill of Manchester's technique in the cure of prolapse. He misses an excellent opportunity in his discussion of the ductless glands by not mentioning any of the more recent advances in the knowledge of the function of the ovary. On the other hand I prefer his entirely agnostic point of view to that of the uncritical "endocrinologist." In discussing Sampson's chocolate cysts, he emphasizes Bailey's work, which is hardly known in this country. Special chapters are devoted to *electrotherapeutics in gynecology* (written by Justina Wilson) and *radium in the treatment of carcinoma of the cervix* (written by Malcolm Donaldson). The appendix contains some instruments of which only the Bonney ligature reel appealed to me. This résumé is far superior to some of the year books regularly published.

Spencer<sup>10</sup> has written a scholarly brochure on *cesarean section*. It is based on 120 personal cases with a maternal mortality of 3.3 per cent, an immediate fetal mortality of 4.1 per cent, and a total infant mortality of 10 per cent. The author emphasizes that cesarean section is too frequently performed at the present time. Some reproductions of quaint woodcuts from ancient manuscripts add to the interest of the volume.

The second edition of Dr. Brodhead's<sup>11</sup> little book on *Approaching Motherhood* has just appeared. It is presented in the form of questions and answers in order to simplify its use by the expectant mother. The advice given appears sound throughout and is presented in a readable form.

De Cotret<sup>12</sup> has written a short elementary compend for the obstetric nurse, which has little to differentiate it from the many similar books on the market. This compend is evidently designed for the French-speaking portion of Canada.

<sup>9</sup>Recent Advances in Obstetrics and Gynecology. By Aleck W. Bourne, F.R.C.S., P. Blakiston's Son and Co., Philadelphia, 1926.

<sup>10</sup>Cesarean Section, With a Table of 120 Cases. By H. R. Spencer, M.D., William Wood and Co., New York, 1926.

<sup>11</sup>Approaching Motherhood. By George L. Brodhead, Ed. 2. Paul B. Hoeber, Inc., New York, 1925.

<sup>12</sup>L'Obstétrique des Gardes-Malades. By E. A. René de Cotret, Montreal, 1925.

We have also just received another of De Cotret's<sup>13</sup> books, published seven years ago, also in French, dealing with normal and pathologic puerperal conditions.

Eberhart<sup>14</sup> is the author of a short pocket compend on obstetrics for the young and inexperienced physician who occasionally turns towards obstetrics.

#### MISCELLANEOUS

J. Shelton Horsley's<sup>15</sup> *Operative Surgery* is unique in that it subordinates the purely technical descriptions to the physiologic result to be expected and obtained by operative procedure.

This second edition has incorporated Costain's lymphaticostomy for septic peritonitis, Stookey's operation for innervating paralyzed muscles, Finney's pylorotomy, Graham's pulmonary pneumectomy, and Cutler's valvotomy for mitral stenosis, as well as such other new operations as those for angina pectoris, and the method for intestinal resection devised by Kerr. The fact that Horsley has abandoned his own technic in favor of Kerr's, speaks highly for the author's open-mindedness, which is shown throughout the text.

For the reader interested in dealing not only with purely technical methods but also desiring to appreciate the underlying principles, the recognition of which differentiates a mere technician from a true surgeon, this book is to be recommended highly.

A magnificent *atlas* of *operative cystoscopy* comes from the pen of Ryall<sup>16</sup> of London. It covers the entire subject of technic as applied to this branch of examination, including anesthesia, the treatment of ureteral stone, dilatation of the orifice of the ureter, litholapaxy, as well as the removal of foreign bodies from the bladder. The treatment of bladder tumors is dealt with, as well as the use of diathermy and other methods in the treatment of prostatic diseases. The appendix describes the author's universal cystourethroscope. The main bulk of this impressive volume is taken up by the 115 wonderful plates, the greater majority of which are in colors and represent cystoscopic pictures drawn from nature. These cystoscopic pictures illustrate almost every conceivable condition in a lifelike manner. The legends appear in three languages, English, French, and German, so as to be readily used by readers of different nationalities. Of particular interest are the pictures taken in succession of the change in appearance of different conditions as the result of treatment or of the progress of a condition, for instance, such as is shown on Plate 12, beginning with the periureteral, bulbous edema resulting from the presence of an intramural stone; the appearance of the same ureteral orifice seven days later when the stone is just beginning to be born into the bladder; the subsequent appearance immediately following the application of diathermy, and finally a picture of the stone after expulsion. Illustrations of cystoscopic instruments in situ during, for example, the incision of a ureteral opening for the release of an impacted stone, might be mentioned.

<sup>13</sup>*Suites de Couches Normales et Pathologiques.* By E. A. René de Cotret, Montreal. La Cie D'Imprimerie Godin, Ltee, 1919.

<sup>14</sup>*Geburtshilffliches Brevier für Aerzte und Studierende.* By Dr. Franz Eberhart, Urban und Schwarzenberg, Berlin, 1925.

<sup>15</sup>*Operative Surgery.* By J. Shelton Horsley, M.D., Ed. 2, C. V. Mosby Co., St. Louis, 1924.

<sup>16</sup>*Operative Cystoscopy.* By E. C. Ryall, F.R.C.S., C. V. Mosby Co., St. Louis, 1925.

This atlas should prove of the utmost use, particularly to those who have not had the opportunity to become familiar with intravascular conditions from a large material. A welcome addition would have been an index of the plates.

A most interesting symposium covering the facts and responsibilities of birth control has been edited by Adolf Meyer.<sup>17</sup> The contributors are twelve in number, and all their contributions show a uniform standard of excellence. I think that the sentence written by Adolf Meyer in the preface, "Our primary concern is the development of a conscience concerning procreation," touches the keynote of the entire symposium. Dr. Meyer justly emphasizes the conservative (I might add ultraconservative) attitude of the medical profession toward birth control, a topic which is regularly excluded from textbooks, professional journals, and the curriculum of medical schools. The two bugbears most dreaded as an effect of this movement seem to be an undesirable spreading of promiscuity as well as the danger to the health of the participants.

The separate articles give a clear-cut, impartially presented and most gripping view of the entire problem from many aspects. Among the various topics emphasized, I might instance both physical and mental hygiene, the menace of overgrowth of population, the relation to public health, the ethical and social points of view, the biologic factor, and many other issues. The authors are representative in many fields: Adolf Meyer, psychiatrist at Johns Hopkins, Margaret Sanger, one of the main motive forces in this movement, C. C. Little, president of the University of Michigan, Raymond Pearl, the statistician, to mention only a few.

This little book should be read both by the friends and adversaries of the birth control movement, because both sides will profit by the impartial light thrown upon this important topic.

*Lynch and Felsen*<sup>18</sup> have written a book on the *pathology, diagnosis and treatment of tumors of the colon and rectum*. The anatomy is treated in a clear, if somewhat brief fashion. Chapter III, dealing with the pathology, is very satisfactory, because the authors have included a very brief clinical outline of the case, and it is always wise to contrast the pathology of the dead tissues directly with the clinical aspects of the condition. It appears to me that the authors might have added the outcome and result to these clinical briefs. The illustrations of the gross and microscopic conditions are satisfactory and instructive. I cannot praise the chapter dealing with the surgical treatment as highly, because, for example, in dealing with the perineal resection of the rectum, too many intermediate steps have been omitted, particularly in the illustrations, to make the exposition clear, especially to beginners. Another addition, which I hope will appear in future editions, will be an assembled table which gives the results obtained by the authors' personal experience with operations. The general make-up of the book is faultless and extremely attractive.

The twelfth edition of a very popular English textbook,<sup>19</sup> namely,

<sup>17</sup>*Birth Control. Facts and Responsibilities.* By Adolf Meyer, M.D., Williams and Wilkins Co., Baltimore, 1925.

<sup>18</sup>*Tumors of the Colon and Rectum. Their Pathology, Diagnosis and Treatment.* By J. M. Lynch, M.D., and J. Felsen, M.D., Paul B. Hoeber, Inc., New York, 1925.

<sup>19</sup>*The Diseases of Children.* By the late Sir James Frederic Goodhart. Edited by George Frederic Still, M.D., F.R.C.P., Ed. 12, Lea and Febiger, Philadelphia, 1926.

that originally written by the late Sir James Frederic Goodhart and now edited by George F. Still, appears five years after its predecessor. The editor has attempted to retain the flavor imparted by the senior author but has tried to incorporate the newest acquirements, such as, lymphadenoma, encephalitis lethargica, the Schick test, the vitamins in connection with rickets and scurvy, and similar topics.

*International Clinics*,<sup>20</sup> as usual, covers a large group of subjects, only a few of which are of immediate interest to the gynecologist and obstetrician. G. P. Laroque reports 1,000 consecutive cases of *appendicitis* operated upon by himself. Of these, 830 were clean cases (mortality of 0.5 per cent). The entire mortality for the series was 2.1 per cent. The large number of clean cases makes the critical reviewer wonder how many of these were benefited by operation. C. Jeff Miller has contributed a timely article on the *contraindications to the use of radium in gynecology*. The article by N. B. Gwyn on *Massive Collapse of the Lungs* is of most interest where referring to the postoperative occurrence of this rare complication.

*Nephritis* by Elwyn<sup>21</sup> gives a comprehensive presentation of some of the modern theories dealing with diseases of the kidney. It covers the physiology of this organ, renal insufficiency, uremia, and the as yet unsatisfactory classification of nephritis. He explains the pathology and clinical changes occurring in the course of pregnancy, on the basis of a general arterial contraction from the beginning of pregnancy. The author assumes that there is a purposive mechanism consisting of an increased irritability of the pregnant uterus, as well as that of the entire neuromuscular mechanism, which has to do with the function of uterine contraction, in that this mechanism results from a similar hypersensibility of the presiding centers in the brain. In certain cases the other vegetative centers in the brain, especially those dealing with vasoconstriction, which are closely adjacent, are likewise affected. He believes that an external stimulation to this vasoconstriction apparatus may be due to the hemolysis caused by the incompatibility between the blood of the child and that of the mother. This highly speculative hypothesis does not appear to be borne out, in my opinion, by such clinical data as have accumulated up to this time. A valuable bibliography will be found at the end of each chapter.

This little manual,<sup>22</sup> printed on extremely thin paper so as to occupy a small compass, consists of three hundred sixty-one pages of text. It covers the treatment of dangerous hemorrhages occurring in pulmonary, cardiac, nervous, gastrointestinal and renal systems, also obstetric hemorrhages, as well as poisonings. This rather heterogeneous conglomeration is fairly well handled. The treatment is based upon Lenzmann's books and schematization. This book may prove of value to those unexpectedly and unpreparedly confronted with emergencies.

Drouet<sup>23</sup> has issued a third edition of his treatment of syphilis by means of bismuth according to the methods used in Paris hospitals.

<sup>20</sup>*International Clinics*. A Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles. Volume I. Thirty-sixth Series, 1926, J. E. Lippincott Co., Philadelphia and London, 1926.

<sup>21</sup>*Nephritis*. By H. Elwyn, M.D., The Macmillan Co., New York, 1926.

<sup>22</sup>*Manual of Emergencies*. By Dr. J. Snowman, William Wood and Co., New York, 1926.

<sup>23</sup>*Le Traitement de la Syphilis par le Bismuth*. By Dr. Georges Drouet, Ed. 3, A. Maloine et Fils, Paris, 1926.

He claims that bismuth treatment is indicated where intolerance or resistance to arsenicals is encountered.

Morison and Saint<sup>24</sup> have prepared this second edition of *An Introduction to Surgery*. The text consists of an elementary treatise for the medical student, covering the general principles underlying surgical diseases. The treatment of the subject is simple, clear, and direct. The chapter on natural cures is well worth careful perusal. This chapter deals mainly with biliary conditions. The final chapter dealing with pathologic conditions, illustrating the application of the general principles, is a good summary of the entire volume. The illustrations are good.

*Pygmalion or the Doctor of the Future*,<sup>25</sup> appearing in the *Today and Tomorrow Series*, is designed to demonstrate that a symptom need not necessarily be a sign of disease, that a given symptom may be but an "altered reaction to life occasioned by the presence of disease." The author makes his point cleverly and clearly.

Dickson's<sup>26</sup> presentation is a farrago of quotations, surmises, and assertions which do not deserve serious critique. "There is a distinct and separate hormonal entity in the axillary and pectoral lobes (of the breast) respectively." Does he refer to the cow or the biped? We are glad to learn that imperforate hymen is not amenable to endocrine treatment. John Hunter should turn in his grave when his dictum "Don't think—try" is perverted to such ends. In his summary the author modestly disclaims "perfection for this work."

<sup>24</sup>*An Introduction to Surgery*. By Dr. R. Morison and Dr. C. F. M. Saint, Ed. 2, William Wood and Co., New York, 1925.

<sup>25</sup>*Pygmalion or the Doctor of the Future*. By R. M. Wilson, M.B., Ch.B., E. P. Dutton and Co., New York, 1926.

<sup>26</sup>*Rational Gland Therapy for Women. Particularly in Relation to Menstruation*. By I. Wanless Dickson, M.B., F.R.C.S., London, H. K. Lewis and Co., Ltd., 1926.

## Item

### A NEW DELIVERY BED\*

BY GEORGE GELLHORN, M.D., F.A.C.S., ST. LOUIS, MO.

The delivery bed here presented possesses several distinctive features.

1. The footrests which commodiously incase the entire foot, are on a level with the bed. This means that, during the second stage, *the auxiliary musculature of the abdomen can come into play* far better than if the heels were suspended from upright leg holders or if the legs were held by attendants.

2. Conveniently shaped knee supports prevent fatigue. These and the footrests are easily adjusted to suit the size of the individual patient.

3. Washable straps around both the ankles and the knees effectually secure the legs in any desired position without excessive restraint, and render unnecessary the services of the two attendants who are usually needed for that purpose. In training schools, therefore, *nurses have an opportunity to watch the progress of labor rather than act as human leg holders*.

4. Shoulder braces, readily adjusted and well padded with spongy rubber, prevent the patient from moving her hips away from the edge of the bed. The patient thus lies, throughout the second stage, *in a perfectly natural, comfortable, and non-fatiguing position which she cannot change, even when only incompletely narcotized*.

\*Demonstrated at the meeting of the American Gynecological Society, Washington, D. C., May 4 to 6, 1925.

The thick and resilient mattress of spongy rubber (not shown in the photograph) adds to her comfort, and the natural flexion of her hips forestalls the severe strain upon the sacroiliac joints to which patients in labor are often subjected.

5. The absence of uncontrolled movements upon the part of the patient safeguards the disinfection of the external parts, which is frequently nullified in other styles of delivery beds, and *the aseptic draperies are never disturbed.*

6. *The vulva remains exposed to view at all times,* and the extent of exposure can always be regulated according to the requirements of the case.

7. The perineum is not overstretched as in any form of exaggerated lithotomy position; hence, *deep lacerations are less likely to occur* if the labor is conducted with sufficient obstetric skill.

8. An adjustable shelf beneath the buttocks provides a convenient resting place for the baby until the cord is severed, and a receptacle for instruments, should perineal repair be necessary.

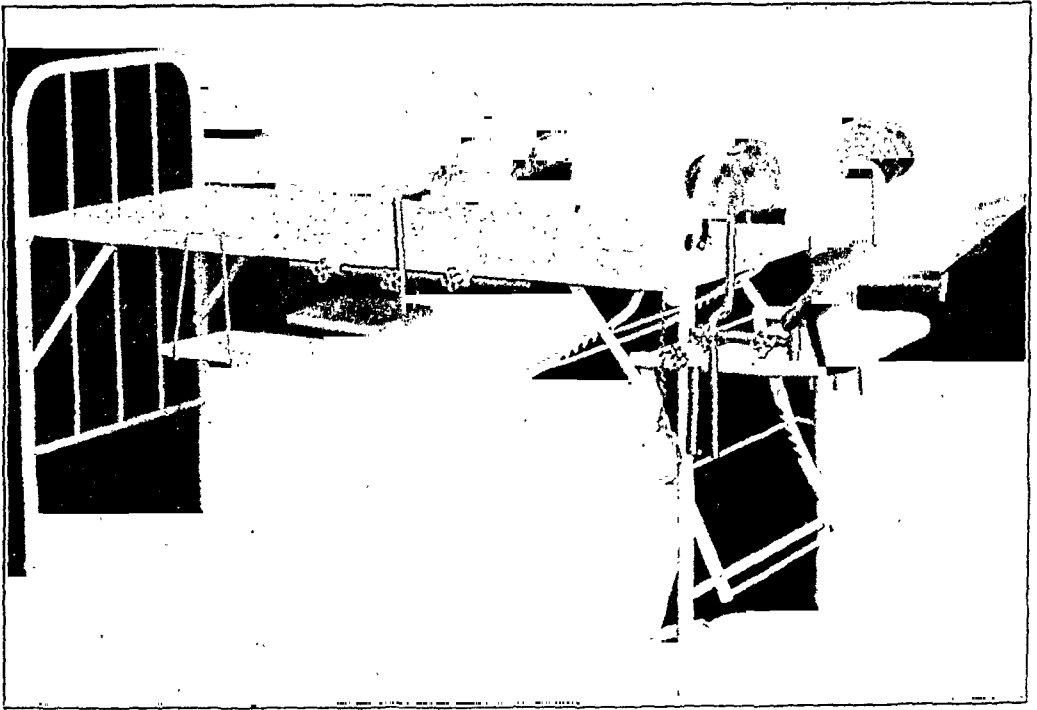


Fig. 1.

9. Provision is made to raise the pelvis for the few occasions where this would be desired (reposition of prolapsed cord, etc.).

10. Strong trays, firmly attached to the frame near the head end, serve for all appliances of the narcotizer and make additional furniture in the delivery room superfluous.

11. After narcosis is instituted, the hands of the patient may be secured in a leather sling (not provided with the bed), which excludes any interference from that source and enables the anesthetist to attend to his work without additional assistance. The nursing force is thereby eliminated as far as the maintenance of the patient's position is concerned—an obvious advantage, particularly in night deliveries.

12. The sturdy, yet extremely simple construction of the bed and its moderate price\* are further points of value.

METROPOLITAN BUILDING.

\*Built by the Smith-Davis Hospital Bed Company, St. Louis.

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## Original Communications

### THE ASSOCIATION OF CONGENITAL DIVERTICULA OF THE FALLOPIAN TUBE WITH TUBAL PREGNANCY\*

By F. P. McNALLEY, B.S., M.D., F.A.C.S., St. Louis, Mo.

*(From the Department of Obstetrics, Washington University School of Medicine)*

ALTHOUGH congenital diverticula of the tube, lined by folds of tubal epithelium and separated by muscle from the main lumen, have been frequently suggested as occasional factors in the development of tubal pregnancy, the frequency of their occurrence and their importance in the etiology of tubal pregnancy has not been widely emphasized.

These, of course, explain the imbedding of the ovum only as a result of actual mechanical retention. It is, however, debatable whether this alone can be responsible and one should not discuss tubal pregnancy without at least mentioning the possible rôle played by some peculiar receptivity of the tube, making the development of the ovum possible. Careful study of some cases in the human subject has failed to show any obstruction and in addition experimental work causing obstruction has failed to produce tubal pregnancy. This work has been chiefly done by Loeb, who ligated the tubes and failed to observe any ova develop. By placing the ligature so that a minute amount of uterine mucosa remained distal to the ligature, however, he observed implantation at this point. He concludes from this that besides the obstruction, the factor of a suitable soil must be present, and that this is not present in guinea pigs but probably is in the human tube. He has also shown that in exceptional cases it is possible for the ovum to fix itself in the peritoneal surface of the uterus and to undergo the first stages of development without the aid of a decidual reaction on the part of the host tissue. His experiments also show that obstruction is an important factor.

\*Read before the Washington University Medical Society, February 8, 1926.

NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."



There are many conditions which would account for obstruction, but the ones of particular interest are blind pockets, either congenital or acquired as the result of inflammation. The latter have been generally believed to be the most important and are the most common lesions reported by previous investigators, notably Hoehne, who believes adhesions between folds of the mucosa or the invasion of tube wall for short distances by tubal epithelium, the so-called salpingitis isthmica nodosa, caused by previous inflammation, are the most important factors.

Opitz also believes this is the most frequent cause of tubal pregnancy. This same opinion is held by C. D. Williams, who says that false diverticula formed by adhesions of the folds of mucosa as the result of inflammatory processes cause 95 to 98 per cent of the cases, and that true diverticula are the rarest of tubal malformations.

J. W. Williams in 1891, called attention to diverticula from the lumen extending into the wall of the tube, reaching almost to the peritoneal surface, which he said may bear a causal relation to tubal pregnancy.

Landau and Rheinstein, also in 1891, reported a case of six weeks' pregnancy in a diverticulum, basing their diagnosis upon the fact that the ovum was close under the peritoneum and the tube lumen was almost unchanged.

Henrotin and Herzog reported a similar case.

Rubin demonstrated an ovum fourteen to fifteen days old in the isthmus of a tube associated with a diverticulum but not the cause of it, because the ovum was imbedded distal to it and at the site of a muscular spur which narrowed the lumen.

In 1924, Schoenholz raised the question of whether changes which have been considered inflammatory are not really congenital, namely, the fusion of folds of mucosa and also salpingitis isthmica nodosa. He believes there are two types of deformities resulting from a disturbance of development during embryonic life. 1. Those where an invasion of the mucosa occurs into the musculature, partly with folds and partly without, the true diverticula. 2. Such defects as are characterized by a division of the free lumen into separate spaces by folds of mucosa.

Mickovitch found anomalies, either congenital or acquired, in all of his cases. There were accessorial passages or spaces adjacent to the tube, and it was nearly always possible to prove that the imbedding of the ovum originated in these accessorial passages. He could also nearly always find the communication of the passage with the main lumen. These passages were either congenital or the result of inflammation, such as growth of the mucous membrane, suggesting adenoma-like formation with numerous branched spaces or adhesions of the mucous membrane.

The material for this study consisted of thirteen tubes removed at operation, twelve of which were the site of a pregnancy. The other was an apparently normal tube removed along with the ovary. This was the first specimen in which diverticula were seen and hence it is included in this report. It was intended to make reconstructions from complete serial sections of all the specimens, but this was found to be impossible in some. It was possible to do this in four cases, three pregnant and one nonpregnant. All but two of the remaining were sectioned serially so the diverticula when present could be traced and described, but on account of the sections lost between blocks, could

not be accurately reconstructed. Of the two not sectioned serially, one had marked convolutions and one was too large to make this method of study practical. In the twelve pregnant tubes, diverticula were demonstrated in ten, or 83.3 per cent. In all, of course, the pregnancy had been disturbed so that the actual implantation could not be shown. In two cases, however, the demonstration of the only signs of pregnancy, i.e., blood and villi in the blind end of a diverticulum (Cases 5223, Fig. 8, and 4854, Fig. 23) seems to prove that this was the cause of the arrest of the ovum. In another (Case 5638, Fig. 13) the site of the pregnancy was distal to two septa, almost occluding the lumen. It is reasonable to assume that this malformation may have been the cause of the arrest of the ovum. We must be content in the other nine pregnant tubes with diverticula to show them as cases of tubal pregnancy associated with diverticula, without being able

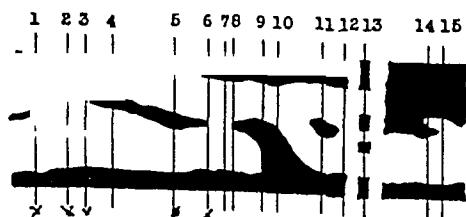


Fig. 1.—Lab. No. 4118. Diagram (drawn to scale from serial sections) showing arrangement of the diverticula in a nonpregnant tube. Section through 13 is shown in Fig. 2.

to prove actually the arrest of the ovum in a blind pocket. No diverticula or other possible etiologic factor was found in two cases, even though they were completely studied by serial section.

In addition to the congenital diverticula there were, in four cases, gland-like inclusions in the tube wall lined with columnar or cuboidal epithelium, the so-called adenomyosis or salpingitis isthmica nodosa.

As far as inflammation in our cases is concerned, we were unable to prove its previous existence except in one case, where definite pelvic adhesions were found at operation, showing the existence of a previous peritonitis. Microscopic study showed, of course, the cellular infiltration always found in association with a pregnancy which has been disturbed, whether uterine or tubal, and which it is impossible to distinguish from true inflammation. In no case could we demonstrate blind pockets in the mucosa alone. The detailed description of the eleven cases with diverticula, ten pregnant and one nonpregnant, follows:

*Lab. No. 4118.*—This apparently normal, nonpregnant tube was removed with the ovary containing an endometrial cyst. In the routine study a block was taken from the ampulla; it showed three distinct lumina. Unfortunately, by the time the sections were studied this block had been lost, but the remainder of the tube was sectioned serially and the complicated diverticula shown in the diagram (Fig. 1) were

found. This diagram is drawn to scale and is accurate except that because the original block was lost we were unable to determine the origin or the termination of the three lumina, which are shown in Fig. 2.

*Lab. No. 4540.*—Distal half of tube enlarged to 1.5 cm. in diameter, dark blue in color, with superficial veins markedly injected. Fimbriated end entirely normal, with



Fig. 2.—*Lab. No. 4118.* Section 13, shows three widely separated lumina. These could not be traced, as explained in the text.

no evidence of bleeding. Tube sectioned in its entirety. The enlargement and color of the tube are seen to be due to a hematoma 0.5x1 cm., in the wall of the tube. Careful search of many sections failed to show any villi in this clot. We were able to trace two true diverticula, as is shown in the diagram, Fig. 3, which is a reconstruction from serial sections. The areas from which the photomicrographs were taken are numbered. The lumen distal to the origin of one diverticulum (Fig. 4)

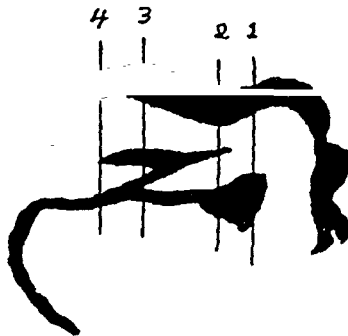


Fig. 3.—*Lab. No. 4540.* Diagram (drawn to scale from serial sections) showing diverticula in a pregnant tube. Sections indicated by lines shown in Figs. 4, 5, 6, and 7.

was filled with a blood clot in which there were a few villi. These were the only ones found and hence it was impossible to demonstrate the site of implantation.

*Lab. No. 5223.*—The tube is 5.5 cm. long and 1.5 cm. in diameter at the ampulla. The fimbriated end is free and the tube was split for 3.5 cm. from the fimbriated end, so that now in the fixed condition the cut edges have retracted, exposing a pro-

Fig. 4.

Fig. 5.

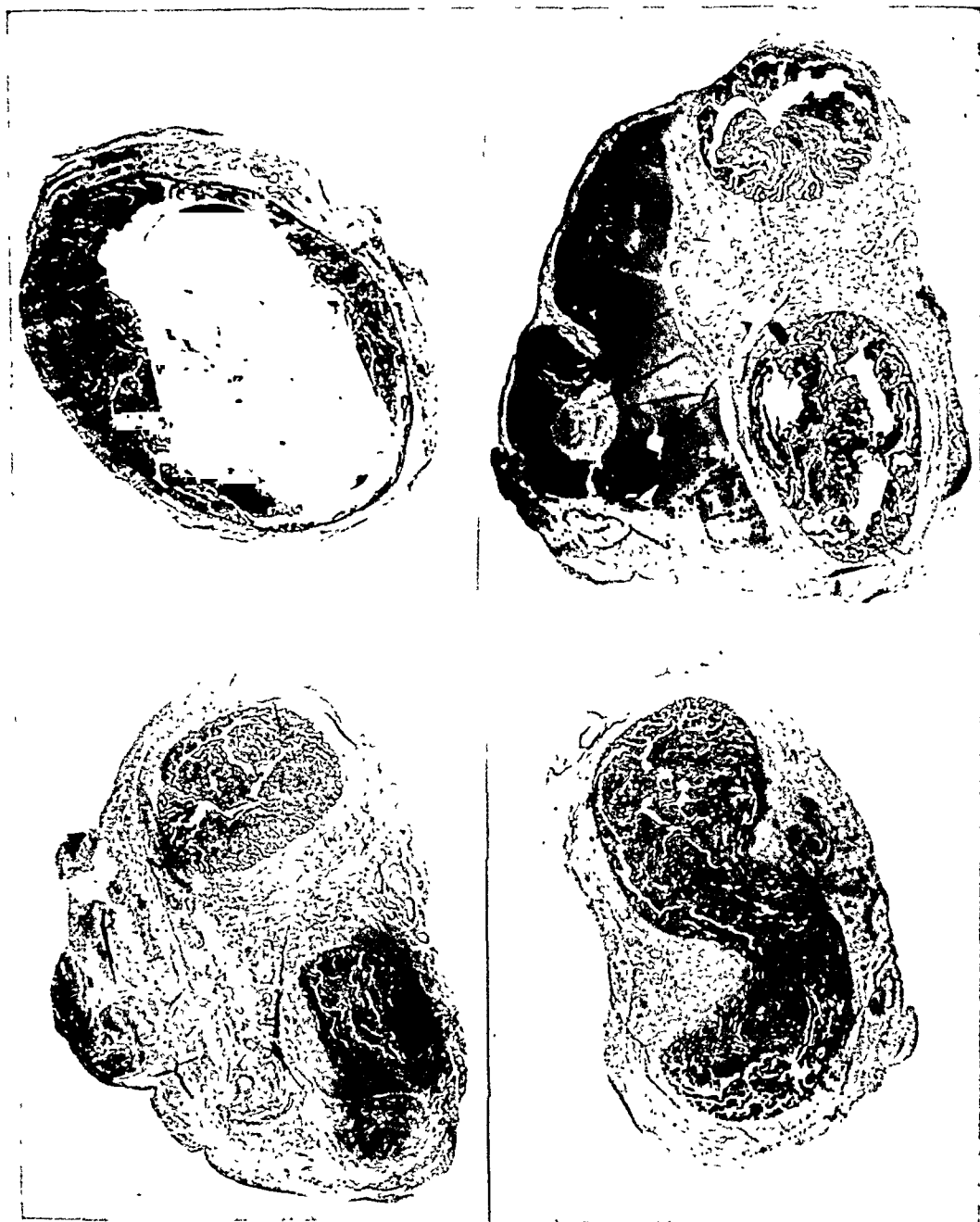


Fig. 6.

Fig. 7.

Fig. 4.—Lab. No. 4540. Section 1, shows lumen distal to the diverticula filled with blood clot containing villi.

Fig. 5.—Lab. No. 4540. Section 2, shows the diverticulum at the bottom and the main lumen at the top. The hematoma in the wall contained no villi.

Fig. 6.—Lab. No. 4540. Section 3, shows the other diverticulum.

Fig. 7.—Lab. No. 4540. Section 4, shows the convergence of the diverticulum and main lumen.

truding blood clot 3.5 cm. long and 1.5 cm. in diameter attached to the tube over a very small area. An attempt has been made to show these relations and also the diverticula in the diagram which is shown to scale from serial sections. (Fig. 8.) From the fimbriated end to Section 2, there is a single large lumen illustrated in Fig. 9, the blood clot containing villi being seemingly on the outside, due to the fact that it was opened while fresh and retracted during fixation. Fig. 10 shows the beginning of the septum (marked by arrow) separating the lumen from the diverticula. Fig. 11 shows the main lumen continuing with the blood clot in the diverticula, and Fig. 12 is taken at just about the blind ending of the diverticula. This case shows without question that the site of the pregnancy was in the diverticulum.

*Lab. No. 5638.*—Tubal rupture at isthmus. The tube is 5 cm. long and the middle 4 cm. is enlarged to 1.5x2 cm., with an opening 0.5 cm. in diameter, 1.5 cm. from uterine end. No adhesions. On section the enlarged portion of the tube is filled with what appears to be placental tissue and blood clot. The tube, with the exception of the fimbriated end and 0.5 cm. of the uterine end, was cut into five blocks and sectioned serially, and a diagrammatic reconstruction made as shown in Fig. 13. The ovum was, of course, disturbed and its original site of implantation could not be shown, but the evidences of pregnancy, i. e., villi and blood clot, were all found in a diverticulum lined with tubal mucosa, and which has a very small connection with the main lumen. Other diverticula and septa are best explained by the diagram and sections.

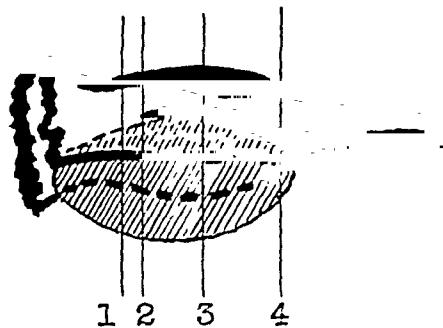


Fig. 8.—*Lab. No. 5223.* Diagram (drawn to scale from serial sections), showing blood clot with villi caught in blind end of diverticulum, which had been split open in the fresh state, allowing the clot to protrude.

*Lab. No. 4391.*—Only about the distal half of the tube was available for study. This, with the adherent blood clot and tissue resembling placenta measures 8x3.5x2.75 cm. The blood clot is densely adherent about the fimbriated end which is distended by placental tissue. Sections through the fimbriated end showed numerous chorionic villi in the lumen and buried in the tube wall. As the uterine end was approached the villi disappeared, but the lumen was well filled with blood and there appeared an accessory lumen which later joined the main lumen. Owing to the fact that serial sections were not done when this specimen was first received we were unable to determine the origin of this diverticulum and cannot prove that it had any connection with the pregnancy, so must be content to show this case as one of a tubal pregnancy associated with diverticula, without proving any relation between the two. The photomicrograph shows the one lumen filled with blood and the other flattened out and near the periphery.

*Lab. No. 4644.*—What is apparently a complete ovisac, measuring 2x2x1 cm., was found in blood clot outside the tube. Only the distal portion of the tube was removed. It measured 4 cm. long by 3x2 cm., and was surrounded by blood clot which occluded the fimbriated end. This was cut into two blocks and sectioned almost

Fig. 9.



Fig. 10.



Fig. 11.

Fig. 12.

Fig. 9.—Lab. No. 5223. Section 1, taken distal to the diverticulum, showing clot in the main lumen, the walls having retracted since it was opened before fixing.

Fig. 10.—Lab. No. 5223. Section 2, taken just at origin of diverticulum. Arrow points to the septum.

Fig. 11.—Lab. No. 5223. Section 3, shows the clot in the diverticulum with its walls retracted and the separate main lumen.

Fig. 12.—Lab. No. 5223. Section 4, taken at the blind end of the diverticulum. Several sections further on it has completely disappeared and the main lumen above continues.

serially. We were unable to prove the original site of implantation, villi being found in the lumen and tube wall in many sections, but think it probable that it occurred near the fimbriated end.

The most interesting feature of the specimen is the accessory lumina or true diverticula which we have been able to trace. Starting near the fimbriated end there is a single very large, irregular lumen with villi implanted in the wall, which divides into two, one with the appearance of a normal lumen and the other very irregular with the walls in apposition (Fig. 21). The latter divides into two parts, the smaller of which again divides. These three diverticula, each surrounded by muscle, can be followed to their blind termination, leaving only the main lumen. In none of these could the site of implantation be found. All the blocks could not be studied satisfactorily on account of the destruction of the ovum, etc., so there might have been other diverticula which could not be demonstrated. Besides these large diverticula there are many microscopic gland-like structures in the wall (adenomyoma). On the surface of the tube are many structures which we take to be epithelial implantations as described by Sampson. There are also in the tube wall many lumina lined by multiple layers of round or polygonal cells probably representing remains of Gaertner's duct.

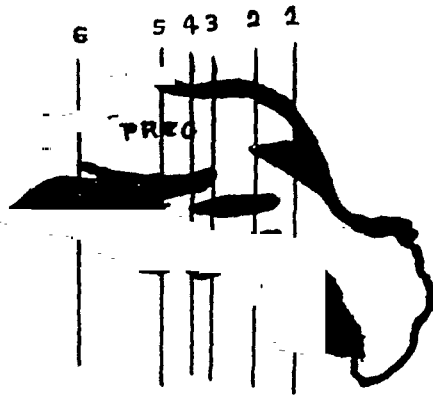


Fig. 13.—Lab. No. 5638. Diagram (drawn to scale from serial sections), showing complicated diverticula and the very small opening (at section 6) proximal to the pregnancy.

*Lab No. 4780.*—Accurate gross and microscopic study of the specimen was impossible because it had been opened longitudinally along the distal half while in the fresh state and a clot 2x1 cm. had been removed. As received in the laboratory in the fixed state it was distorted, which made it impossible to secure sections sufficiently close to serial to reconstruct the entire tube. It was practically normal in size, with the incision exposing the lumen to which the clot adhered. No fetal or chorionic tissue was recognized in the gross. Entire tube was cut into blocks. About the middle there was a blood clot in the wall. The diagnosis of pregnancy was made certain by the finding of villi in the clot removed from the lumen, and also in the lumen of the tube. The blood in the wall described in the gross was borne out on microscopic section, but no villi or embryo were found in it. Throughout almost the entire tube wall are scattered inclusions of acini lined with columnar epithelium (adenomyoma). In addition we have been able to trace two true diverticula. The opening of one into the lumen was not demonstrated because sections at this point could not be obtained, but from the sections available it seems justifiable to conclude that such an opening was present. The other one could be demonstrated entirely. Both ended blindly in the wall toward the proximal end of the tube. The site of implantation of the ovum could not be identified. The illustration (Fig. 22)

Fig. 11.



Fig. 15.

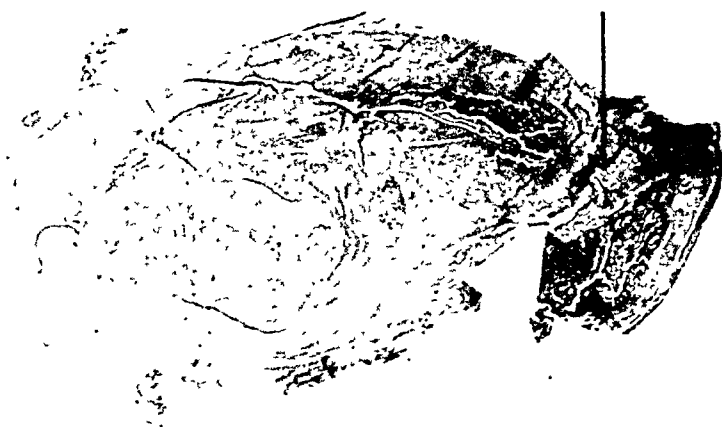


Fig. 16.

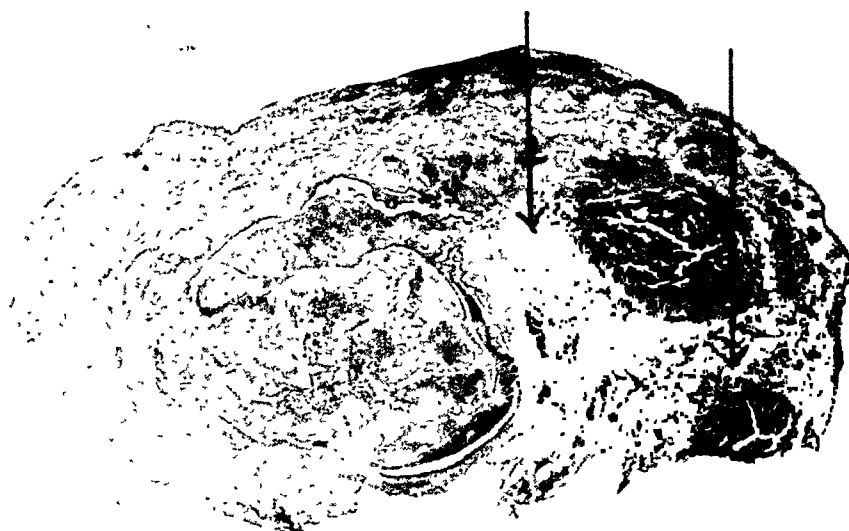


Fig. 14.—Lab. No. 5638. Section 1, taken through the septum between the site of pregnancy at this point, marked by arrow, and the main lumen below.

Fig. 15.—Lab. No. 5638. Section 2, taken just at tip of septum shown in Fig. 14, and showing a second septum which has appeared below, marked by arrow.

Fig. 16.—Lab. No. 5638. Section 3, shows a third septum (left arrow) and the second septum as in Fig. 15 (right arrow).



Fig. 17.

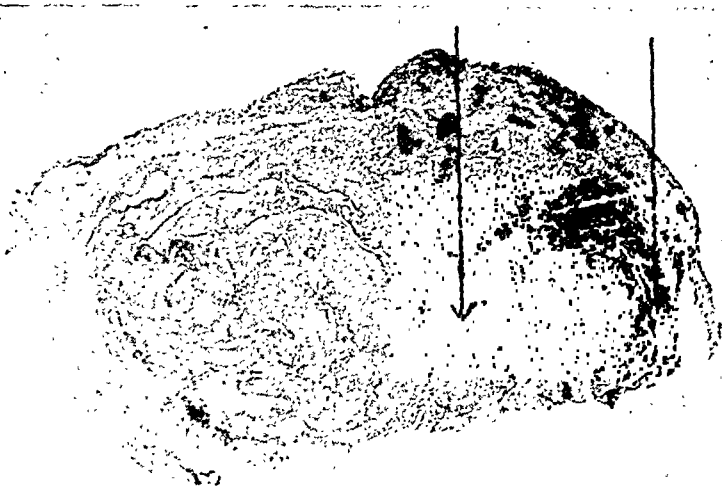


Fig. 18.

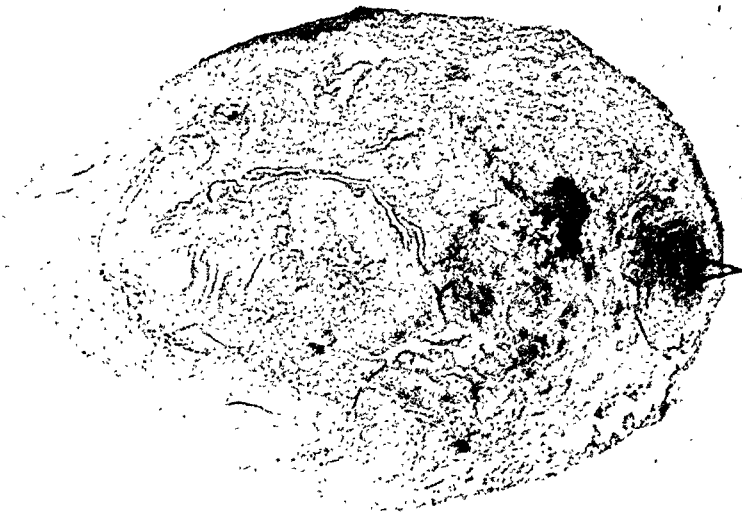


Fig. 19.

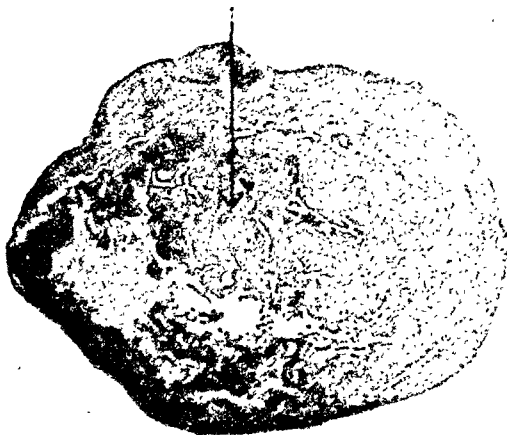


Fig. 17.—Lab. No. 5638. Section 4, taken just beyond the tip of the second septum (right arrow), the third septum being marked by right arrow.

Fig. 18.—Lab. No. 5638. Section 5, taken through the tip of a very small septum dividing this diverticulum in two just before it ends blindly. To left is the large lumen containing the blood and villi.

Fig. 19.—Lab. No. 5638. Section 6, taken just at the tip of a small septum (indicated by arrow) which with a similar one just opposite almost occludes the lumen, the pregnancy being distal to this point.

shows the opened lumen and also another, deep in the tube wall. Small gland-like structures can also be made out.

*Lab. No. 4854.*—Specimen consists of both tubes and ovisac with the fetus, which is a male, measuring 9.5 cm. in length. The pregnant tube measures 8 cm. long and 3.5 cm. in diameter at its largest portion, the ampulla. The fimbriated end is dilated and there is a rent extending from the fimbriated end inward for 3 cm. The ovisac, open and collapsed, now measures 6 cm. in diameter and the placenta is attached to the inner surface of the tube through this rent. On section of the tube there is seen in the ampulla, at the place where the placenta has been described as being attached to the inside of the tube, another lumen measuring 7x4 mm. Entire tube was cut in blocks for serial study. The extra lumen described in the gross is also shown microscopically, as is another smaller one—these in addition to the large space occupied by the ovisac. The placenta is torn away but many villi still remain, and that this was a lumen is easily told by the intact tubal epithelium which still remains. Following these two smaller ones through serial sections it is seen that the smaller

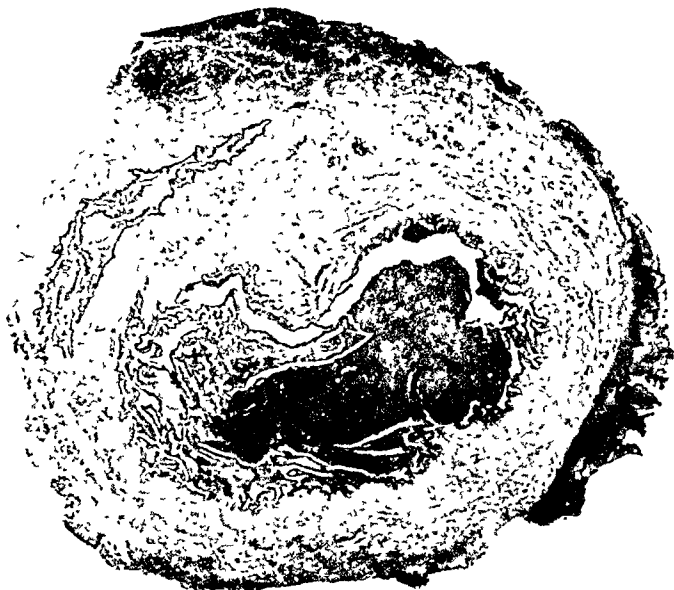


Fig. 20.—Lab. No. 4391. Shows one lumen filled with blood and another flattened out close to periphery on right.

one gradually increases in size and finally joins the larger one, continuing as one for a short distance, when they again separate; one gradually decreasing in size to end blindly. Through many sections there is just the one lumen and then again another one appears and continues separately but later joins the first. Throughout all these sections the large ruptured lumen continues. It had evidently been torn throughout its entire length, so that in the sections it disappears along the outside of the tube where there was old adherent blood clot. Serial sections continued proximal to the gestation sac show also accessory lumina. A second one appears and finally fuses with the first and at the most proximal portion apparently enters the uterus as a single opening.

This case is interesting because we have at the site of pregnancy three distinct lumina, one of which, very large and ruptured, is the site of implantation. This one is entirely separate from the others and in the study of serial sections definitely does not continue throughout the tube but is lost and disappears apparently along the outside of the tube. This is doubtless a case where the ovum was arrested in a blind end of an accessory lumen. The photomicrographs show two lumina in addition to

the site of the ovisac. The other tube shows an adenomyoma of the interstitial portion.

*Lab. No. 5002.*—The tube measured 6 cm. in length and 2x2.5 cm. in diameter for 5 cm. of its length. Fimbriae were normal. No adhesions and no blood externally. Tube cut into six blocks. About the middle the lumen was dilated to 1.25 cm. with blood clot. Distal to this the increased size of the tube was due to thickening of the

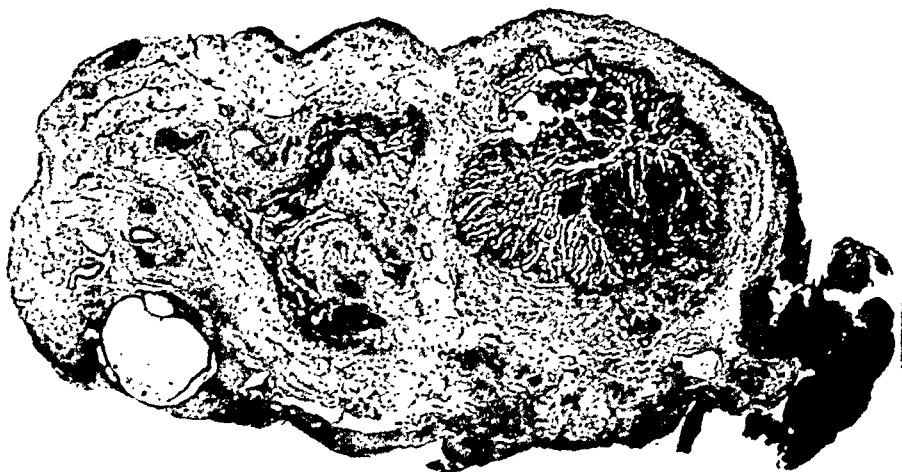


Fig. 21.—Lab. No. 4644. To the right is seen the main lumen; to the left the diverticulum.



Fig. 22.—Lab. No. 4789. The open lumen is shown to the right and a diverticulum is seen almost in the center, deep in the tube wall.

wall. Distal to the blood clot no abnormalities are seen. Unfortunately, sufficient sections were lost between two blocks to make the demonstration of the origin of the diverticula possible. A single extra lumen, one-fourth as large as that containing the blood clot with villi, is seen. This divides into two and a third makes its appearance just at the edge of the section, and the three continue through about one hun-

dred sections. Then two unite (Fig. 24) and later this one disappears, the remainder continuing until another diverticulum branches off from the large lumen, and these two unite to form one. Here again sections were lost between blocks so the end of this could not be demonstrated, the remainder of the blocks showing no diverticula. The site of implantation could not be identified because there were only a few villi in the blood clot.

*Lab. No. 5225.*—Specimen consists of tube with small portion of the cornua of the uterus attached. The isthmus and ampulla are of normal size, but the fimbriated end is lost in a large mass measuring 5.5x4.5x5 cm. When received, this mass had been opened and was filled with old blood clot. No structure recognizable. On cross section the wall varied from 4 mm. to 2 cm. in diameter, the thickest portion containing a lumen 8 mm. in diameter and separate from the larger cavity containing the old clot. Microscopically this large cavity is lined by tubal mucosa and sepa-

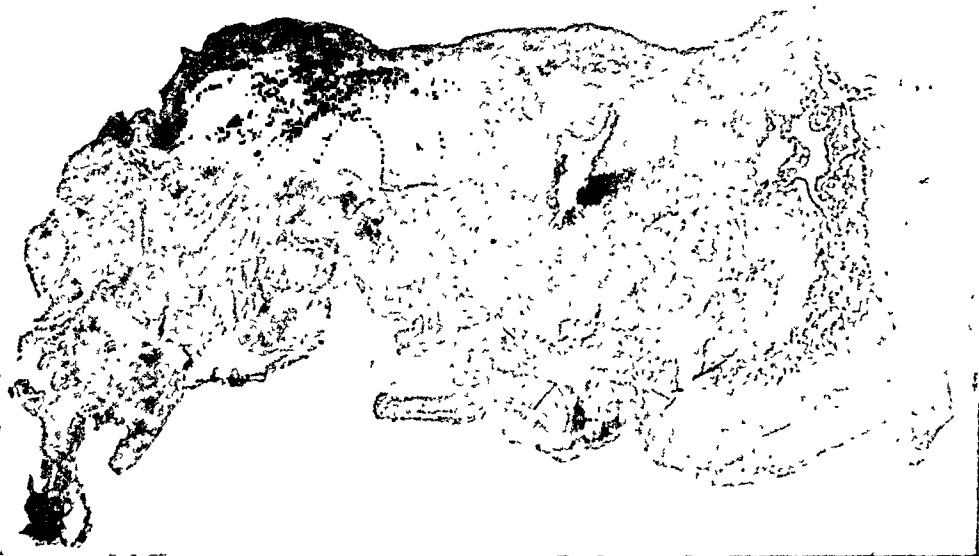


Fig. 23.—Lab. No. 4854. The opened lumen which contained the ovum is seen below, with some blood clot containing villi still adherent. To the right a large lumen and just to the left of this a smaller one.

rated by muscle from the smaller lumen (Fig. 25). One of these is a diverticulum. On account of the size of the specimen serial sections were impractical, so we cannot demonstrate the junction of the diverticula and main lumen. All that can be said is that here is a case of tubal pregnancy associated with a diverticulum. Several other features of the specimen are interesting. First sections through the cornua of the uterus show numerous cavities, some cystic and larger than the lumen, scattered diffusely through the muscle. They are lined with columnar or cuboidal epithelium without surrounding stroma (adenomyoma). There is also a moderate round-cell infiltration. The isthmus shows the cavities to a lesser extent, but some of them are filled with blood. The ampulla proximal to the pregnancy shows marked polynuclear and round-cell infiltration, both in wall and mucosa. At the site of the pregnancy round cells predominate.

*Lab. No. 5484.*—The tube is free of adhesions, markedly convoluted and measures 6 cm. in length. Fimbriae are free. Two and five-tenths cm. from the uterine end

is an enlargement 1 cm. in diameter. On account of the marked convolutions, serial sections, as far as diverticula are concerned, would be valueless. Only one thin block could be secured without the possibility of cutting the same lumen twice. From



Fig. 24.—Lab. No. 5002. The main lumen filled with blood is seen at the right. To the left three diverticula, two of which are just uniting.

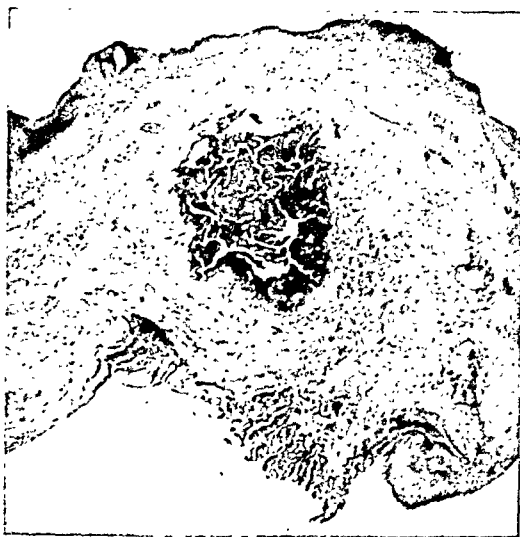


Fig. 25.—Lab. No. 5225. Below is the opened lumen which contained the old clot. Above is another lumen.

this enough sections were obtained to demonstrate a diverticulum and its junction with the main lumen. Both contained blood clot and villi. The illustration shows the two lumina both containing blood and villi.

## CONCLUSIONS

Of twelve cases of tubal pregnancy, diverticula were demonstrated in ten, or 83.3 per cent.

In three of the ten cases the malformation was directly responsible for the arrest of the ovum, and it probably was in the others.

In view of these findings, even in so small a series, it seems reasonable that diverticula are more common than is usually believed, and that they are an etiologic factor of considerable importance in the production of tubal pregnancy.

Since preparing this paper there has appeared in the *Archiv für Gynäkologie*, 1926, cxxvii, 609, an article by Schoenholz entitled "Untersuchungen über die Ursachen der Eileiterschwangerschaft," in which he reports the examination of thirty-two pregnant tubes. In fifteen there were congenital diverticula; in two there was division of the lumen into separate spaces by mesh formation of the mucosa, a con-



Fig. 26.—Lab. No. 5484. Shows two lumina, both containing blood and villi.

genital defect. In seven cases there were both diverticula and mesh formation. In two cases there were diverticula plus cystogenic tissue. In six cases no cause was found. In none of his cases does he think inflammation played any part in the anomalies. Inflammation can cause adhesions and kinks, however, and in this way may also be the cause for tubal implantation, but it cannot be decided how great a rôle these adhesions play in disturbing the passage of the ovum or what their influence upon its retention in a pocket.

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## PREGNANCY IN UTERUS DIDELPHYS\*

BY PALMER FINDLEY, M.D., F.A.C.S., OMAHA, NEB.

THE doubling of the uterus has little clinical significance other than in event of pregnancy. Indeed, it may be said that this malformation is compatible with a normal sexual life save in exceptional instances. From a study of recorded cases one is impressed by the frequency with which the anomaly remains unrecognized even in event of childbearing. Furthermore, it is apparent that radical measures have been employed in not a few instances and sometimes to a degree that cannot be justified in the light of accumulated experience.

In the uterus didelphys the bodies are completely separated and are commonly of unequal size. As a rule they lie in the same transverse plane, though occasionally they are found one in front of the other and particularly so in event of pregnancy, the empty uterus lying behind the pregnant body. The cervixes are completely separate or welded together. The vagina is usually divided unequally by a more or less complete septum. The adnexae do not differ from those associated with a normal uterus save in the relative frequency of hematosalpinx when associated with atresia of the cervix and vagina. It is noted that the inner surfaces of the divided bodies are avascular in that the uterine and ovarian blood supply is confined to the outer aspects of either half of the uterus. The two bodies are in part separated by a vesicorectal fold of peritoneum which is said by some authorities to account for the failure of coalescence of the müllerian ducts. In several of the recorded cases there has been a doubling of the vulva, urethra, and bladder and wide separation of the pubic bones. This broadening of the pelvis is thought by some to be an etiologic factor in the development of a double uterus in that the müllerian ducts are widely separated and fail to coalesce. Secondary sex characteristics are noted, such as abundant distribution of hair and small breasts.

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Of the lesions associated with the double uterus, hematometra is the most common. Two cases are reported by Gross in which hematometra was bilateral. When unilateral and the other uterus menstruates at intervals, the clinical diagnosis is confounded and in event of torsion of an accompanying hematosalpinx or of an ascending infection arising out of a long-standing hematometra, much confusion may arise both in diagnosis and treatment. It is of interest to observe that in an ascending infection of gonorrheal or puerperal origin the resultant lesions are commonly unilateral and lend themselves to conservative surgery, if such be indicated, in that the unaffected side may be left to carry on its normal functions.

In all cases, before resorting to operative interference, it is well to catheterize the ureters because of the occasional absence of the right kidney and ureter. In no case has the left kidney been found want-



Fig. 1.—Case 1. Uterus didelphys in thirty-sixth week of pregnancy. Pregnancy in right uterus. Left uterus previously pregnant with delivery of dead fetus at seventh month of gestation. Completed operation.

ing. Jaboulay records a case in which a hysterectomy was done for cancer of the cervix and the only existing ureter was severed.

Referring to the frequency of uterus didelphys, Stolper found ten in 7400 married women, while Neugebauer found but three cases in 19,000 examinations. Guerin-Valmale asserts that pregnancy occurs in two-thirds of all cases. The case of Robertson suggests the unusual fertility of some of these cases. In his case there were delivered, one baby in the first pregnancy, two in the second, three in the third, four in the fourth and three in the fifth, making in all a total of thirteen babies in five pregnancies. In the last labor the uterus ruptured. There are numerous instances where from three to nine babies



have been born and not infrequently the malformation was not recognized until after two or more deliveries. Long-standing sterility has been relieved in a few cases by severing the vaginal septum, thereby demonstrating that sterility is not always chargeable to the doubling of the uterus. H. Bernard collected 100 cases of uterus didelphys; in five of this number cohabitation was embarrassed by a septum vaginae; seven were sterile, 26 aborted, and 46 gave birth to viable babies.

It is generally conceded that abortions are more frequent in the didelphic than in the normally developed uterus. Dunning estimates the frequency of abortions at 23 per cent of all cases. Boin finds one interruption of pregnancy to 3.3 per cent of full-term pregnancies.



Fig. 2.—Case 2. Full-term pregnancy in uterus didelphys. Double vagina, double cervix, double corpus, normal tube and ovary attached to either body of uterus. Pregnancy in right uterus fourteen months before. Patient delivered with difficulty through natural passage at seventh month of gestation. Baby died on third day. Delivered five pound perfectly formed baby from left uterus by abdominal cesarean section, March 2, 1922. Mother and baby OK. Picture shows completed operation.

Gouterman records a case in which there were three full-term deliveries and nine abortions. Picot's case had 14 abortions. Wertheim holds that the relative frequency of abortions is accounted for by the poorly developed uterine musculature, which Rokitanski describes as very thin. In this connection we recall the case of Oker-Blom in which there were nine pregnancies—five on the right side and four on the left. The left uterus was the smaller of the two and all four of the pregnancies on that side ended prematurely, while from the fully developed uterus on the right side all five pregnancies went to full term.

The diagnosis of pregnancy in uterus didelphys is presumedly difficult if we are to judge from the many instances in which the condition has failed of recognition. If the case is first seen late in pregnancy there is little likelihood of recognizing the anomaly because the empty body usually lies behind the pregnant uterus and the cervix may be so elevated as to be inaccessible to the examining finger. As evidence of the difficulties in diagnosis, witness the many cases in which there was a preoperative diagnosis made of pregnancy complicated by fibroids, ovarian cyst or ectopic pregnancy. In a few instances the diagnosis was not made until after a uterine sound was passed into either uterus, or the abdomen opened and operative measures well under way, even to the extent of inadvertently opening into the pregnant uterus. It is when the nonpregnant uterus menstruates



Fig. 3.—Case 3. Uterus didelphys with full-term pregnancy in right uterus. Primipara. Baby in situ.

at intervals that confusion in diagnosis is most likely to arise. Bucura, however, doubts the occurrence of menstruation from the empty uterus and opines that the cause of menstruation, whatever it may be, operates on both sides simultaneously.

The duplexity of the uterus presents numerous instances of what may well be assumed to be examples of superfetation. There is an unobstructed passageway through the vagina, cervix, nongravid body and on to the ovary, together with a genetic reaction within the uterus as evidenced by the development of a decidua. Independence in function is evidenced by the recurrence of menstruation in the nongravid uterus throughout part or the whole of the period of gestation in the other body. Some there are who will not accept the theory of superfetation, preferring rather the theory of arrested development.

Dubierre reports a case of twin pregnancy with an interval of fourteen weeks between deliveries. Frepet's case had an interval of two weeks and in the case observed by Williams there was a full-term birth followed by the expulsion of a four months' fetus. Küstner finds a maximum of seventy-four days between deliveries.

It is of interest to note the behavior of the nongravid uterus. It serves as an appendix to the pregnant uterus and as the pregnancy advances it is commonly dragged behind the pregnant uterus where it may and indeed frequently does retard the progress of labor. It may contract during labor and thereby contribute its quota to labor pains. In many instances the cervix is observed to dilate in labor. Commonly by the third, fourth, or fifth day of the puerperium the decidua is cast off from the nongravid uterus, either in its entirety or in fragments. Pery reported a case in which the decidua was expelled prior to labor, and Blaise one in which the decidua was expelled five months after labor. Retained decidua may lead to infection. Axler is of the opinion that puerperal infections more often arise from the nongravid side. Meriel's case developed a pyometra which called for hemihysterectomy. Accompanying the expulsion of decidua, the loss of blood may be very great.

The behavior of the pregnant uterus is of paramount interest in respect to the management of these cases. In the minds of some who have reported cases there seems to have been grave doubts as to the ability of the uterus to perform its function and an unwarranted emphasis has been placed upon the casualties involved in labor; hence, the numerous cases in which Poro operations and cesarean sections with sterilization have been performed. It is true that labor is somewhat prolonged, due to the underdevelopment of the uterine musculature and cervix, to the relative frequency of breech presentations and more than all to the encroaching empty uterus. In this connection we note with interest the case of Leve in which there were eight easy, rapid labors, followed by a ninth pregnancy with the development of a mole. In ten recorded cases labor was obstructed by the presence of a hematocolpos, requiring the emptying of the blood before delivery could be effected. Rupture of the uterus has been reported by Boni, Winter, Donald, Walls, Gossel and Tissier, Rokitanski and Moldenhauer and postpartum hemorrhages are perhaps a little more frequently encountered than in the normally developed uterus, but these casualties are not so frequent as to warrant radical surgical intervention in advance of a test of labor.

It is evident that the management of pregnancy and labor in uterus didelphys should differ not at all from that of pregnancy in the normally constituted uterus. Only in the event of complications should operative interference be invoked. Spontaneous delivery is possible, is frequently accomplished and should, therefore, govern our conduct.

The double uterus lends itself to conservative management in that it may be possible to sacrifice one uterus and conserve the other. Where, however, the two bodies are welded together, such conservatism is impossible. Döderlein observes that many of these cases are delivered spontaneously; that version and forceps deliveries are relatively frequent; that craniotomy has been performed in exceptional cases and, finally, that cesarean section affords the greatest satisfaction. In a case of Döderlein's the baby's life was lost through prolonged labor. In a subsequent labor he chose cesarean section, saving both mother and baby. On the other hand Jeff Miller cites a case in which a spontaneous delivery was effected two years after a hemihysterectomy.

The percentage of breech presentations is high. Polak estimates the frequency at 40 per cent. Shauta says that operative measures are indicated only in the presence of an obstructing septum vaginae or empty uterus incarcerated behind the pregnant uterus. He would sever the vaginal septum and, failing to dislodge the incarcerated nongravid uterus, he would do a cesarean section. Veit would choose between cesarean section, forceps, and version, having failed to dislodge an impacted nongravid uterus. The delivery of the placenta may be likewise embarrassed by the encroachment of the nongravid uterus. In event of uterine rupture, or the presence of fibroids and ovarian cysts, the management does not differ from that of a normally formed pregnant uterus with like complications.

W. Herwin reported a case in which he divided the vaginal and cervical septa, removed a pus tube, did a salpingostomy on the opposite side, suspended either half of the uterus and subsequently delivered a baby through the natural passage. Barton Hirst writes of a case in which he proposed to perform a plastic operation to correct the deformity, but the woman became pregnant before she could decide to be operated. Derner reports a case where coitus was practiced *per urethram*. Dilatation of the vagina was soon followed by pregnancy.

I have collected 132 cases from the literature and personal correspondence to which I have added three of my own, making a total of 135 cases. All represent a complete doubling of the uterus, cervix, and vagina, and all have been pregnant. From personal correspondence I am indebted to the following for case reports: Harold Miller, Heaney, Curtis, Campbell, Polak, Norris, Stein, Ehrenfest, DeLee, Farrar, J. T. Baldwin, Lauf, Brooke Bland, Barton Hirst, E. W. Power, DeNormandie, Greenhill, Jeff Miller, E. L. King, Mundell and from the Sloane Hospital for Women the four cases of Williams, W. M. Findley, Levey, and Bunzel. Analysis of these cases discloses the following data:

In the 135 cases there were 217 full-term babies born; 83 spontaneous deliveries, 23 cesarean sections, 1 craniotomy on a dead fetus, 2 Porro operations, 1 hemihysterectomy, and 1 death from rupture of the uterus.

The indications for cesarean section were: delayed labor due to encroaching empty uterus, 5 cases; puerperal convulsions, 2 cases; atresia of the vagina, 1 case; insufficient pains, 1 case; toxemia, 1 case; simple flat pelvis, 1 case; fear of thin uterine wall, 1 case; breech presentation, 3 cases. In the remaining 8 cases no other explanation was given than the presence of a double uterus, and in one instance a double cesarean section was performed in a twin pregnancy.

Dr. Farrar did a hemihysterectomy on a case in which Dr. Cragin had removed the body of one uterus. In this case there had been three abortions. Heaney delivered by cesarean section at full term and excised the tube on the pregnant side upon observing the extreme thinness of the uterine wall. In a case cited by Polak he performed a cesarean section and four years later a baby was born spontaneously. In two cases there was drainage of an obstructing hematocolpos before delivery could be effected; one was delivered by forceps, the other by version and extraction. There was retention of the placenta in two cases requiring manual removal. In one of these cases the patient died on the operating table. The septum vaginae was divided in three cases to permit of delivery.

The 22 remaining cases were delivered by forceps or version and extraction.

In the 135 cases there were: 216 full-term babies with 6 deaths, 13 twin pregnancies, 15 premature deliveries, 86 abortions, 2 malformations of the baby, and 13 breech presentations.

Following are the three cases which have occurred in my private practice:

CASE 1.—Mrs. W., age twenty-three. Para ii. Referred by Dr. F. S. Williams, Villisea, Iowa. Duplexity of uterus, cervix, and vagina discovered by Dr. Williams when he had delivered with great difficulty a dead seven months' fetus about two years before. The placenta adhered. The left uterus was pregnant. The second delivery was estimated at about the thirty-sixth week of gestation. After four hours of hard pains, in the absence of any dilatation of the cervix or engagement of the presenting part, an abdominal cesarean section was done on the right uterus. The right tube was resected. Mother made an uneventful recovery; the baby was living and well-formed. There were no pelvic abnormalities in the mother.

CASE 2.—Mrs. S., age twenty-five. Para ii. Double uterus discovered in first pregnancy five years ago when the appendix was removed. This pregnancy went to full term and a dead fetus was removed by cesarean section after four days of labor. An infected wound resulted. Patient lost blood almost continuously throughout the following year. I first saw the patient in the eighth month of her second pregnancy. She was poorly nourished and anemic. The right half of the uterus extended to the costal arch, the left uterus had rotated behind the pregnant uterus and was estimated to be the size of a man's fist. There were two completely sep-

arated cervixes and the vagina was equally divided by a thick vertical septum. I performed a second cesarean at the onset of labor in view of the history of having had a previous cesarean and this followed by an infected wound. The baby weighed four pounds and eight ounces, had club feet and gave evidences of prematurity. It died in forty-eight hours. The mother made an uneventful recovery. The tube on the pregnant side was resected in the second cesarean. Both pregnancies occurred on the right side. There were extensive adhesions throughout the pelvis. The previous cesarean scar was firm.

CASE 3.—Mrs. S., age twenty-two. Para i. Referred by Dr. A. C. Stokes of Omaha. The patient had a justo minor pelvis, was poorly nourished and extremely neurotic. The pregnancy proceeded to full term with breech presentation. The baby was in the right half. The left uterus was enlarged to the size of a four weeks' pregnancy and lay behind the pregnant uterus. At onset of labor, at request of patient and husband, an abdominal cesarean section was performed. Whether this patient could have delivered spontaneously or with forceps or version I do not know but unquestionably the labor would have been difficult and prolonged because of the small pelvis and breech presentation. Mother made an uneventful recovery, baby lived and was well developed.

#### CONCLUSIONS

1. The uterus didelphys is compatible with a normal sexual life save in exceptional instances.
2. The anomaly is often unrecognized even in event of childbearing.
3. Unusual fertility is demonstrated in many cases. Abortions are relatively common and labor is prolonged as a result of poor muscular development in the uterus, small rigid cervix, and the encroaching nonpregnant uterus.
4. Errors in diagnosis have been frequent, due to the difficulty in recognizing the nongravid uterus in advanced pregnancy and the occasional recurrence of menstruation throughout the pregnancy.
5. The behavior of the nonpregnant uterus is of interest in that it may contribute to the labor pains by its contractions, the cervix may dilate and very commonly a decidual membrane is expelled on the second or third day of the puerperium. Its greatest interest centers in the fact that it not infrequently retards the progress of labor by becoming incarcerated in the hollow of the sacrum.
6. The management of pregnancy and labor in the uterus didelphys should not differ from that of pregnancy in the normal uterus save in the event of complications. Spontaneous delivery is the rule.
7. In the event of delayed labor due to an impacted nongravid uterus that cannot be dislodged cesarean section is indicated.

## LIPIODOL AS AN ADJUNCT TO TUBAL INFLATION IN THE DIAGNOSIS OF STERILITY\*

BY LAWRENCE M. RANDALL, M.D., ROCHESTER, MINN.

*(From the Section on Obstetrics, Mayo Clinic)*

TRANSUTERINE inflation of the fallopian tube is a valuable aid in determining the cause of sterility. By its use one is able to determine accurately whether the tube is normally patent, stenosed, or entirely occluded. In rare instances, a stenosed or closed tube is perhaps opened by the pressure employed during inflation, but these instances are so infrequent that the therapeutic value of the Rubin test is practically nil in that respect. In two cases severe obstructive dysmenorrhea was relieved for several months by inflating the tubes to 200 mm. of pressure. Both women had nonpatent tubes and the maximal pressure could be used.

Although the method is a great step forward in accuracy of diagnosis, it does not point out the site of stenosis or occlusion. The closure may be a complete obliteration of the entire lumen or simply obstruction at one point. The situation of the lesion is quite important in considering the prognosis in a given case. It is well known that the fimbriated end is a common situation of adhesions which seal off the tube. Closure at this point occurs in an otherwise normal pelvis and may be amenable to surgical treatment. Closure is also common in the narrowed portion of the lumen, either in the interstitial or isthmic portions of the tube. Obstruction at either of these points is rarely relieved by operation.

It would seem that some method of actually visualizing the site of obstruction would be a valuable adjunct in the diagnosis of the cause of sterility in the female. This idea is neither new nor original, and various substances have been injected into the genital tract for this purpose. Recently a new compound, lipiodol, has appeared which seems well adapted to this use. It is a definite chemical compound in which 40 per cent iodine is firmly bound to poppy-seed oil. It is thoroughly impervious to roentgen rays, noncaustic and nontoxic, because iodine is concealed in the material and cannot be detected by chemical reactions. Out of 5,000 injections made by Sicard and Forestier, there were no accidents except in one case of brain tumor. Injected into the uterus and tubes, lipiodol produces a sharp shadow in the roentgenogram which outlines the cavity of the uterus and the

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\*Submitted for publication, March 31, 1926.

lumen of the tubes. The technic of injection is simple and painless, and a portable x-ray machine yields excellent pictures.

The indications for the use of lipiodol are the same as those for tubal inflation. The contraindications are also identical with those governing the Rubin test, namely, acute or subacute infection and uterine bleeding. The injection should not be given near menstrual periods; it is best carried out half way between them.

The procedure with a sterile patient begins with a carefully taken history and is followed by a thorough general physical and gynecologic examination. The necessary laboratory tests, including the blood Wassermann, are done as a routine. Possible foci of infection are thoroughly investigated. The husband, if present, is examined for fertility. If the husband is absent, the necessity of this examination of the husband by the home physician is impressed upon the patient. If there are no contraindications, transuterine tubal inflation is carried out by the method of Rubin. Should this show normal patency, the injection of lipiodol is usually unnecessary. If the inflation reveals a high-grade stenosis or actual obstruction, lipiodol is injected twenty-four hours later. This interval allows absorption of the carbon dioxide used in the inflation.

The patient is instructed to take an enema shortly before reporting for injection. She is placed in the lithotomy position, a sterile speculum inserted, the mucus cleared from the cervical canal, and iodine applied to the endocervix. This is wiped out with a dry applicator which is allowed to remain in place until the injection is ready. Ten cubic centimeters of lipiodol are sufficient for the ordinary case, and often from 5 to 7 c.c. is enough. An ordinary record syringe is used, to which is fitted the cannula from the Rubin apparatus. The solution is drawn into the syringe, the cannula attached and the solution forced through until all air is excluded. The applicator is removed from the cervix and the cannula inserted. Pressure on the syringe plunger is made gently and slowly until the patient begins to complain of cramp in the region of the uterus. This cramp is due to the distention of the uterus and the tube with lipiodol. Pressure is relaxed for a moment until the cramp disappears and then reapplied until cramp is again noted. The procedure is repeated once more and then the roentgenogram is taken. This technic has been adopted because in some cases the cramp was first noted before the cavity of the uterus and lumen of the tube were completely filled with lipiodol. The incomplete filling obviously results in inaccurate pictures. In the patients with stenosis of the tube, the escape of lipiodol is without danger, according to Forsdike,<sup>1</sup> and in the experience at the clinic no evidence of peritoneal irritation has been noted.

Lipiodol has been used with impunity in the roentgen-ray diagnosis



of diseases in many parts of the body, according to Sicard and Forestier,<sup>2</sup> and Sicard and LaPlane.<sup>3</sup>

The roentgenogram is valuable in enabling the physician to discuss the cause of the sterility and the prognosis with the patient. It gives a clear outline of the point of obstruction which is in itself an index to the value of surgical treatment for a given case.

#### ILLUSTRATIVE CASES

CASE 1.—A woman, aged twenty and married four years, had had one miscarriage four months after marriage, following an automobile accident. No history of infection could be elicited. Shortly afterwards, laparotomy was performed elsewhere for removal of a small cyst from the right ovary, suspension of the uterus, and appendectomy. Recovery was without incident but the patient has not conceived since that

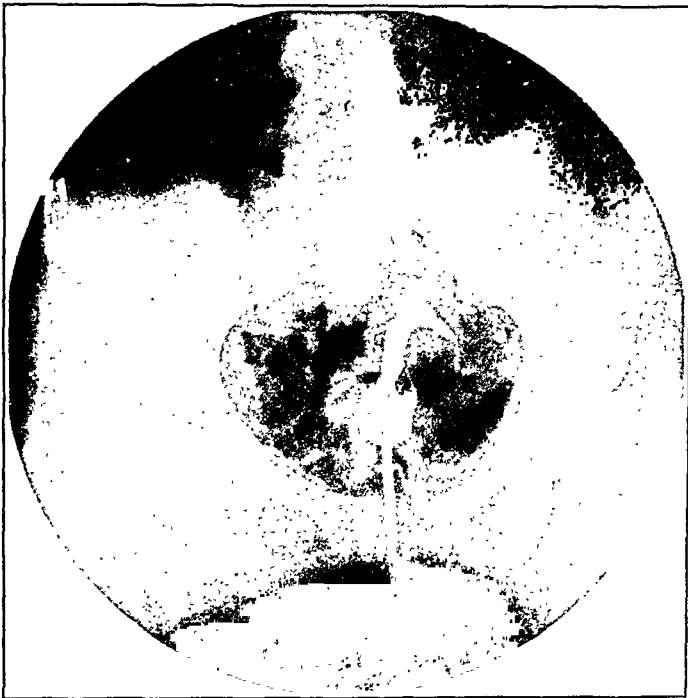


Fig. 1.—Lipiodol in the cavity of the uterus and the lumen of the tubes.

time. Recently, she has complained of pain in the right lower quadrant related to constipation and aggravated by active exercise.

General examination revealed a tonsillar tag in the base of the right fossa, periapical abscess of the upper first molar tooth, and mild cystic mastitis. The urine contained albumin 2 but no casts. A night specimen, not catheterized, showed only a trace of albumin, and the albuminuria was finally determined to be orthostatic. The renal and cardiac findings were negative. Pelvic examination revealed slight vaginismus, cystic cervicitis, and a little nonpurulent leucorrhea. The uterus was in second degree retroversion and normally mobile. The tubes and ovaries seemed clear save that traction on the right adnexa produced the same kind of pain as exercise.

Tubal inflation showed that the cervical canal was easily patent and did not bleed. The tubes were not patent to 200 mm. of pressure. Lipiodol was injected twenty-

four hours later. The roentgenogram shows that the solution filled the cavity of the uterus and the lumen of the tubes (Fig. 1). It stopped abruptly near the outer end, leaving a club-shaped shadow. No solution was evident in the culdesac.

The patient is extremely anxious for children and elected an exploration with the sole idea of obtaining relief from the obstruction near the fimbriated end of the tube. Operation revealed that both tubes were occluded at the fimbriated extremity by calcareous nodules. That on the left was 8 by 3.5 mm., and that on the right was 5 by 5 mm. in size. These were removed, and about one-third of the right tube resected. The left tube was kept practically intact. The uterus was suspended by a modified Gilliam operation. There was an adhesion between the right ovary and cecum which probably explained the pain. This was freed.

*Comment.*—This patient is a favorable type for operation. On the evidence afforded by tubal inflation alone, the operation would have



Fig. 2.—The solution in the uterus and distending the uterine cornua.

been undertaken blindly and perhaps needlessly. With injections of lipiodol, however, the site of occlusion could be predicted and the operation undertaken with some hope of a good functional result. Particularly is lipiodol valuable when, in the presence of nonpatent tubes, bimanual examination and the history do not reveal evidence of pelvic disease.

CASE 2.—A woman, aged twenty-seven, married five years, had never been pregnant. She had had rather severe obstructive dysmenorrhea but no pelvic inflammation. The husband had been examined elsewhere several times and pronounced fertile after each examination. Dilatation for dysmenorrhea was done five years before examination, and dilatation and curettage for sterility three years before, elsewhere. The patient had taken ovarian extract for the last two and one-half years and thyroid extract until her heart "began to pound,"

General examination was negative. Laboratory examinations, including the blood Wassermann, were also negative. Pelvic examination revealed that the uterus was small with a small firm cervix held well out of the posterior fornix. The uterus was normally mobile. No lesion could be made out in either adnexa.

Tubal inflation showed that the cervical canal was normally patent and clean. The tubes were not patent to 200 mm. of pressure. Lipiodal was injected twenty-four hours later. The solution filled the cavity of the uterus and distended the uterine cornua but did not escape into the tubes (Fig. 2).

*Comment.*—As no infectious process had been at work in the pelvis, it is possible that the internal genitalia were underdeveloped, even though the uterus was not typically infantile. Tubal inflation is often unsuccessful in such cases, even when antispasmodics are administered. In this case laparotomy seemed contraindicated.



Fig. 3.—The solution filling the body of the uterus and cornua.

CASE 3.—A woman, aged twenty-six, married five years, had had considerable obstructive dysmenorrhea. The "pus" appendix and the right ovary had been removed elsewhere three years before examination. A cyst of the thyroglossal duct brought her to the clinic, and this was removed here. The patient had had two miscarriages without incident four years before, and the laparotomy followed in six months. There was no history of pelvic infection other than that which might have resulted from the appendicitis.

The general examination revealed negative findings aside from the cyst of the thyroglossal duct. Laboratory examinations, including the blood Wassermann, were negative. Pelvic examination disclosed that the cervix was clean. The uterus was normal in size and shape but pulled to the right and slightly rotated. The tubes were not palpable. The left ovary was slightly tender and not freely movable,

Tubal inflation revealed patency of the cervical canal and slight, rather thick mucous discharge. The tubes were not patent to 200 mm. of pressure.

Lipiodol was injected twenty-four hours later. The roentgenogram showed the body of the uterus and cornua filled with the solution but no filling of the tubes (Fig. 3). Occlusion here was at the proximal end of the tube and surgical intervention seemed inadvisable.

#### SUMMARY

The use of lipiodol offers a further means of accurately diagnosing tubal obstruction and stenosis as a cause of sterility in women. After tubal inflation has shown nonpatency or stenosis of the tube, the site of closure or stenosis can be accurately detected by its use in connection with roentgenograms. This information is of value in considering the advisability of surgical treatment in an otherwise normal pelvis. Such tubes are always symptomless and frequently unaccompanied by other pelvic lesions; hence there would be no other indication for operation. As a rule, women who consult physicians primarily because of sterility are otherwise normal, and it certainly is not justifiable to subject them to surgical operation without the benefit of as accurate a diagnosis as possible. Uncomplicated tubal occlusion is a frequent cause of sterility and the question of laparotomy is often brought up by the patient. If the site of closure can be located, one can much better judge the value of operation in a given case. Should the obstruction be in the narrowed portion of the tube the prospect of success from a plastic operation on the tube will not be good. With pathologic change at the fimbriated end, which is relatively common, and the lumen patent to this point, operation may be justifiable. It carries with it a fair chance of success, provided other conditions are normal.

The technic of injecting lipiodol is simple and involves no special apparatus. It is practically painless. The same care is used as in transuterine inflation of the tubes.

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## A CASE OF EARLY OVARIAN PREGNANCY ASSOCIATED WITH UTERINE PREGNANCY\*

BY HIRAM N. VINEBERG, M.D., F.A.C.S., NEW YORK, N. Y.

OVARIAN pregnancy is of sufficient rarity to warrant the publication of every genuine case encountered. Its rarity may be conjectured from the fact that in a fairly extensive public and private practice extending over a long period, the case I am about to report was the first I found. It has an additional interest in the circumstance that it was associated with intrauterine pregnancy.

Mrs. C. was referred to me Jan. 31, 1926, by her family physician for the purpose of doing a therapeutic abortion. She was thirty-three years of age, married eight years and had given birth to a child seven years before. In the third month of that pregnancy she had a fairly severe attack of pyelitis, with two to three recurrences during the remainder of the gestation. The labor came on at full time, was normal and so was the pregnancy, but she was very slow in recovering, felt weak and tired easily.

About two years before she consulted her doctor as to the risk of bearing another child. He found a fair amount of pus in the urine and an x-ray examination revealed a shadow the size of a ten-cent piece in the cortex of the right kidney. She was referred to a prominent urologist who made a very thorough examination and came to the conclusion that the shadow indicated a renal calculus. Owing to its position, he advised nephrotomy for its removal. The operation was performed in January, 1925. On exposing the kidney no calculus was found, but the organ was fibrous and shrunken to half the normal size and it was, therefore, deemed advisable to remove it. Recovery was uneventful, but since then there has always been a trace of albumin in the urine and an occasional cast.

Her menses set in in her seventeenth year, were of the 4 weekly type, of 4 to 5 days' duration, and rather scanty. Her last menses were on Dec. 2, 1925, and were due again Dec. 30. She was therefore nine days overdue. The uterus was slightly enlarged and in retroversion of the second degree. The cervix showed some appreciable discoloration.

I suggested waiting for another week to make certain of the diagnosis but the patient felt confident she was pregnant, judging from past experiences and from the fact that she never went overtime.

In view of her history and the condition of the remaining kidney, the indication for interrupting the pregnancy admitted of no doubt.

On the following morning, Jan. 9, I performed a curettage at Mount Sinai Hospital. The curette brought away a considerable amount of tissue, which seemed to me the unmistakable products of early uterine conception. There was the usual amount of bloody discharge for the next four or five days; the pulse and temperature remained normal and the patient felt so well that she insisted upon going home on the seventh day.

On Jan. 17, the morning after she left the hospital, she had a slight attack of pain in the left lower quadrant of the abdomen. She stated it was not of a colicky

\*Read at a meeting of the New York Obstetrical Society, May 11, 1926.

nature, but rather like a continuous ache. I saw her at 2 P.M., when there was a recurrence of the attack. I found slight distention of the lower part of the abdomen and on bimanual examination, the uterus was markedly tender. The left fornix was also tender on pressure, but no mass was to be felt. The os was slightly open and there was a scanty pinkish discharge.

I learned now she had had a slight attack of a similar nature on Jan. 13, three days before she left the hospital, but, as it was relieved at once by an enema, it was ascribed to flatulence and no further attention was given to it. The pulse and temperature were normal. My impression was that there might still be some residue in the uterus or retention of the discharge owing to the malposition, but the character of the pain did not tally with that supposition nor did it conform to that of ectopic



Fig. 1.—Low power magnification of section through entire corpus luteum and site of implantation of pregnancy. Defect in this area is site of rupture.

pregnancy, the other condition I had in mind. I gave expression to these two thoughts to the attending physician and to the members of the family.

On the following morning, Jan. 18, there was another attack of pain and again at 6 P.M. I saw her at 7 P.M. The lower abdomen was now more distended, the tenderness of the left fornix was more marked and there was a sense of fullness in the posterior culdesac.

I had no hesitation now in making a definite diagnosis of ruptured ectopic pregnancy. The patient was readmitted to Mt. Sinai Hospital at 10 P.M., and an hour later I opened the abdomen in the median line. There was a fair amount of free blood in the lower abdomen in the pelvis. The left tube looked perfectly normal and

so did the right tube, but there was a small raw area on the surface of the left ovary, which, on closer inspection, proved to be a ruptured corpus luteum. I was inclined to look upon the condition simply as hemorrhage from a graafian follicle or corpus luteum, but the extirpated ovary was subjected to microscopic examination.

The right tube was ligated and cut, the proximal stump being peritonealized. The uterus was ventrofixated and the abdominal wound closed in the usual manner. The patient bore the operation very well and made an uneventful recovery.

*Pathologic Report.*—Grossly the specimen consisted of fallopian tube, ovary and some blood clots. The tube was tortuous and patent and showed no gross abnormal-

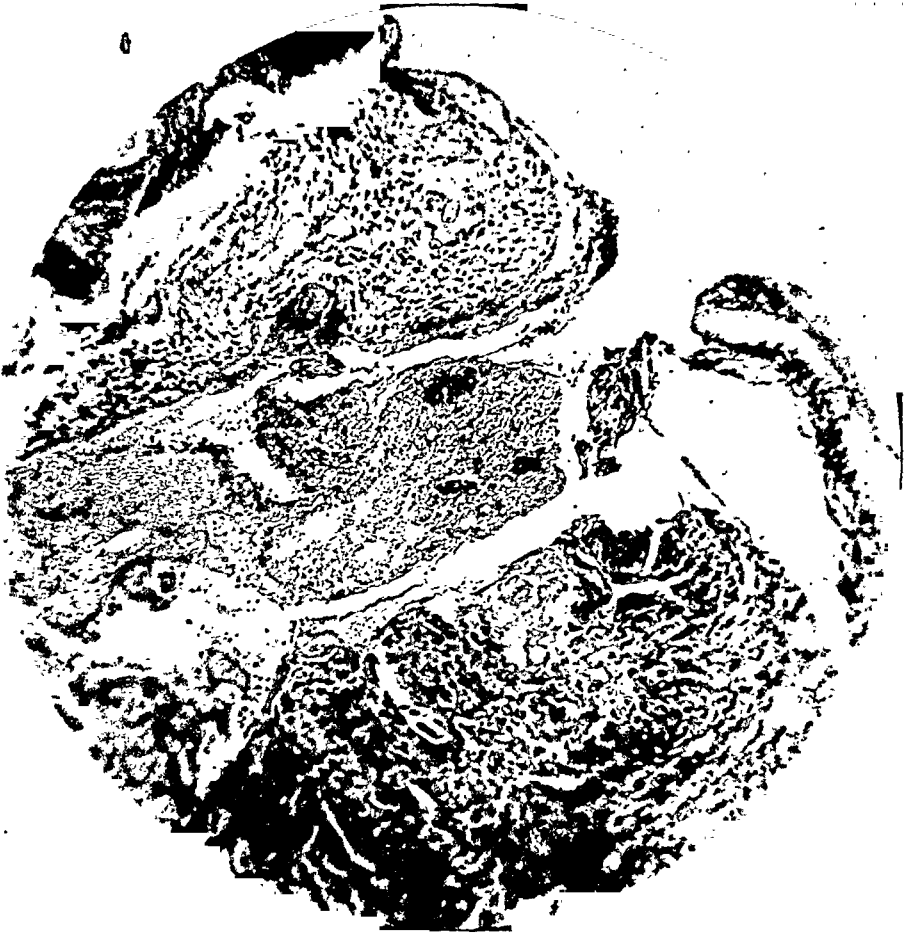


Fig. 2.—Medium power magnification of section showing syncytial and trophoblastic cells.

ity. Directly under the abdominal ostium of the tube and attached to the surface of the ovary is a tiny clot which covers a small defect, measuring about 4 mm. in diameter. This hemorrhagic area apparently is the site of recent hemorrhage. On section of the ovary the blood clot and hemorrhagic defect can be seen resting upon a yellow corpus luteum.

Histologic examination of the corpus luteum and defect shows a well advanced, normal corpus luteum without hemorrhage. The theca luteum cells are well developed. Situated on one point on its outer surface is an area, the base of which shows the remains of granulosa luteum cells infiltrated with blood and surrounded by numerous thin-walled capillaries. Invading the wall of this depressed hemorrhagic area are numerous syncytial masses and clumps of trophoblastic cells. There seems

to be the normal marked tendency for invasion of the vascular channels; some of which are markedly dilated, thin-walled sinuses.

Sections through several areas of the fallopian tube showed no abnormality.

There is great discrepancy as to the incidences of ovarian pregnancy as expressed by different writers. This arises from the circumstance, that even up to the present time, there is no consensus of opinion as to the conditions necessary to establish its presence.

We all know the conditions laid down by Spiegelberg as far back as 1878. They were: (1) the tube on the affected side must be intact; (2) the fetal sac must occupy the position of the ovary; (3) it must be connected with the uterus by the uteroovarian ligament; (4) definite ovarian tissue should be found in the sac wall. To these Williams had added another important condition: ovarian tissue must be present in several portions of the sac wall, at some distance from one another. Morris emphasizes that the adjacent tube should not only be intact, but microscopically free from any of the processes of gestation.

Meyer and Wynne refer to the oft-quoted opinion of Tait, that ovarian pregnancy was rare as a blue lion or a swan with two necks, and also to the opinion of Bland-Sutton, that ovarian pregnancy, not only has no existence, but that it is impossible. This was true in 1899. Bland-Sutton changed his opinion five years later on studying a case reported by Clarence Webster.

Only after 1900 did German writers begin to report cases of ovarian pregnancy with some frequency. Lockyer in 1917 accepted as authentic only 22 of the 58 reported between 1910 and 1917.

Meyer and Wynne maintain, that in the light of our present knowledge, some cases were rejected for insufficient reasons. They hold that not even the entire absence of remnants of the conceptus can positively exclude a case from the category of true ovarian pregnancy. They agree with Scott on a priori grounds alone, that the conceptus may be completely resorbed. This assumption receives support from the case they report and from several cases found in the literature. They make the further assertion that many of the cases of profuse intraperitoneal hemorrhage reported in the literature as being due to rupture of a graafian follicle or corpus luteum, were probably cases of genuine ovarian pregnancy. They maintain that idiopathic hemorrhage from a graafian follicle or corpus luteum is exceedingly rare. In fact, if we were to accept their attitude as to the criteria of ovarian pregnancy, we would never exclude this condition in any case of hemorrhage from the graafian follicle.

This assumption receives some support from the case reported. In most instances it would have been assigned, without further investigation, to the group of follicular or luteal hemorrhage. It might have been done in this instance were it not that I had a very alert assistant.



The discrepancies in the incidence of ovarian pregnancy are well illustrated by the following. Lockyer accepted as authentic only 22 cases of 42 reported between 1910 and 1917. In practically the same period Meyer and Wynne, from 1908 to 1917, collected 58 cases, only 4 of which they deemed doubtful.

Schumann in his monograph on *Extrauterine Pregnancy*, in 1921, quotes Norris' collection of 19 positive cases from the literature up to 1909. He adds the 22 cases accepted by Lockyer from that date to 1917 and the case reported by Meyer and Wynne in 1919, a total of 42 cases. A review of the literature from that date up to the present, shows 17 cases reported. All but three fulfilled the criteria of authentic cases of ovarian pregnancy, thus making a total of 14 cases for the period of 1921 to 1926.

My case falls into the group of early cases. The case reported by Dr. J. I. Hunter is probably the earliest on record. The operation was performed 24 days after the last menstruation. The removed ovary showed the presence of a growing blastocyst, which was apparently less than three weeks of age. This indicated that fertilization must have taken place after the last menstrual period prior to the operation.

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(For discussion, see page 422.)

## THE PRESIDENTIAL ADDRESS\*

### THE AMERICAN GYNECOLOGICAL SOCIETY

BY FRANKLIN S. NEWELL, M.D., BOSTON, MASS.

THE presidential addresses at the annual meetings of this Society combined with the scientific papers form an almost complete record of the development of modern gynecology and obstetrics. The mistakes are recorded equally with the successes and the fact that many procedures now obsolete have been ardently advocated at our meetings does not detract in any way from the value of this record, since we learn more from our failures than from our successes. The completed whole is a worthy monument to the founders of this Society, whose vision has made it what it is.

This meeting marks the completion of fifty years of active work in the life of the Society, and would seem to be an appropriate occasion to recapitulate the constructive work accomplished by our members past and present, but the presidential address of five years ago so completely covered the subject as to leave no opportunity for such a memorial.

When this Society was founded, gynecology was an undeveloped specialty, and obstetrics as practiced today was not even dreamed of. The years which have passed have seen a steady development in gynecology up to its present point of relative perfection. It is hardly possible that a similar development can take place in the next fifty years. The founders of this Society were the pioneers in the specialty and it is to their inspiration that we owe in large part the great advances which have been made. It is interesting to note that in the earlier transactions many procedures now commonplace were once subjects of bitter controversy, while others which were generally accepted have become obsolete. Our predecessors were developing a new field of surgery at a time when asepsis was either unknown or in its infancy, and each step forward was fraught with hypothetical or actual danger. Operations which are now definitely standardized were once considered the height of rashness, while each advance was violently opposed by the conservatives of the time, only becoming accepted after absolute proof of its safety and of its benefits to the patient was demonstrated.

Gynecology has been so developed that we can expect comparatively little advance in its main principles, except in the treatment of malig-

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\*Presented at the Fifty-first Annual Meeting, Stockbridge, Mass., May 20, 21, and 22, 1926.

nant disease, and possibly in the application of the advances which may be made from time to time in our knowledge of the endocrines. Our work as operating and investigating gynecologists must be largely limited to the refinement of diagnosis and to the improvement of operative technic where that is possible. The dangers which beset the paths of our forbears have been largely eliminated.

Equally striking, though less conclusive, developments have taken place in obstetrics, since our whole conception of the subject has been radically altered, but there remain many unsettled problems in this field which require investigation. The literature of the last fifty years shows that not only has the treatment of practically every obstetric complication been radically altered and the possibility of the prevention of many of them become recognized, but obstetrics has been developed into a surgical specialty. The recognition of cesarean section as a legitimate procedure in appropriate cases has made it necessary for the obstetric specialist to be a trained surgeon. As time goes on it may be that the low cervical operation will entirely supplant the classical operation, but outside of this possible development there seems to be no great change which can be made in operative obstetrics except a closer limitation of operations to qualified operators for definite indications.

The application of surgical technic to obstetrics has greatly lessened the frequency of septic infection. In the practice of a well-trained obstetrician of today the development of a case of septic infection of a serious nature is rare, except under conditions which develop when an epidemic, such as influenza, is rampant in the community,—so rare indeed that our interns receive little training in the treatment of this condition. Nevertheless, septic infection is still so common among patients under the care of men not surgically trained that the statement is often made that the conditions have improved little in general practice.

The treatment of septic infection is still unsatisfactory, however. We have learned not to kill our patients by indiscriminate curettage, but we have not yet learned how to control virulent infections except by raising the patients' resistance and thus aiding nature. Prevention rather than cure is our sheet anchor in this important complication. Future progress must place the care of the obstetric patient in the hands of the surgically trained man if septic infection is to be abolished either in hospital or in private practice, and an increasing number of semiprivate obstetric beds must be provided in our hospitals to provide for the safety of those who cannot afford the fee of the specialist and yet do not belong in a charitable institution, this being the class in the community for which little provision is made at the present time.

Our knowledge in regard to the toxemias of pregnancy and eclamp-

sia has been increased to some extent. We have not yet learned what toxemia is, but we have perhaps a greater understanding of what it is not. The advances have been such that we have reason to feel that the development of eclampsia in any patient is a reproach to the attendant and argues either a lack of intelligent prenatal care or an inability to appreciate the warnings of danger. We cannot prevent the development of the milder forms of toxemia in the present state of our knowledge, since we do not know the actual cause. We can recognize the danger signals, however, and either minimize the dangers by prompt treatment or cut short the pregnancy if treatment fails, and thus practically render eclampsia an obsolete condition. The laboratory diagnosis of toxemia by blood chemistry and allied methods is still of little practical value, but an intelligent interpretation of the blood pressure changes combined with accurate clinical judgment will save many lives.

This advance and many other improvements in the care of our patients have been due to the recognition of the importance of careful prenatal study, which is perhaps the greatest advance in obstetrics in the last fifty years. The prevention of complications, or at least their early recognition at a time when they can be adequately treated, is one of the great advances in preventive medicine.

The importance of a careful study of the pelvis has been recognized in this country during the last twenty-five years. Every student in a well organized medical school of today is instructed in the taking and interpretation of the pelvic measurements and in the comparison of the size of the baby with the pelvic canal. In the practice of a well-trained obstetrician no patient is allowed to go into labor today without the possibilities of dystocia having been thoroughly canvassed, and in doubtful cases an appropriate course of action is decided upon in advance for each individual patient, and the patient is given the advantages of modern progress in accordance with her needs.

In general practice, however, little more attention is paid to the pelvis apparently than twenty-five years ago. The attitude of the general practitioner is still one of hope that no untoward conditions are present and that no obstruction to labor exists, rather than one of foresight. It must be remembered, however, that the majority of general practitioners of today, particularly in the smaller communities, were not trained under modern conditions and have had little or no opportunity to improve their early training. A distinct improvement should occur when the men who have been trained in the last ten years come into their own.

Great as the advances in obstetrics have been in the last fifty years it is only a beginning. We know little about the toxemias. We know the end-results in neglected cases. We do not know, however, the etiology or the nature of the poison, and the scientific treatment of the

toxemias must remain in abeyance until the etiology has been definitely settled.

The possibility of the regulation of the size of the fetus is another problem that has not been adequately studied. We do not know how far it may be possible to control the size of the child in a given case without reducing the mother's vitality by starvation to a point which is unsafe. This offers a very attractive field for study.

We are still in doubt as to the best method of induction of labor in cases in which premature termination of pregnancy is necessary. Presumably no single method is applicable to all cases. My own experience leads me to believe that we are using the best of several more or less unsatisfactory methods, rather than that we have discovered an ideal method, and I find that I can never get the results reported by my friends who strongly favor some particular method. These are only a few of the many obstetric problems open to investigation and it is probable that in obstetrics the next fifty years will show even greater advances than the last fifty.

With the development of the obstetric specialist many fads have entered into practice. The delivery of all patients by a certain method undoubtedly renders the individual obstetrician very proficient in that particular operation and thus leads to improvement in the technic of the operation. In his hands the results become exceedingly good, but when less proficient individuals try to follow his example, disaster is sure to follow. The routine induction of labor at a given date, when no indication is present except the saving of time for the patient and attendant, has resulted disastrously for the mother and child in many cases. The operative craze which has led to the performance of cesarean section for no good and sufficient reason has led to the loss of many lives. Obstetrics must be reduced to a sane basis with only one object in view, an increase in safety for mother and child rather than the popularization of any particular procedure before the results can be called satisfactory.

The obstetrician must be trained as carefully as is the surgeon for his life's work. With the increase in the number of well-trained men the results of the future should be much improved. The better education of the men who are to practice and teach obstetrics will result in a better training for the members of the medical profession as a whole and in a steady improvement in obstetric standards. The interest in the study of obstetrics seems to be definitely on the increase among medical students. For the first time they realize that modern obstetrics is more than expectant midwifery, which argues well for continued progress.

This progress in obstetrics and gynecology is part of a general advance which involves the whole of medicine and which has had a great influence on medical teaching. New specialties have been devel-

oped and have found a place in the medical curriculum. The laboratory branches have assumed an increasingly prominent place in medical education and have to a very unfortunate extent encroached upon the time formerly devoted to clinical teaching, and medical education, the final aim of which is the training of doctors, has gradually passed more and more under the domination of the laboratory group, which is composed of men who have never taken care of patients and who have little conception of the training necessary for a practicing physician. We are most of us teachers as well as clinical practitioners, and it is our duty to so train students that they shall be fitted to minister to the needs of patients, unless we are ready to admit that the work of the great clinicians of the past is of no value to the community as compared to laboratory research. A sound scientific training is important, but it behooves us to see to it that the present tendency to over-emphasize the importance of the so-called fundamental medical sciences in our medical schools is reduced to a sane basis. The great majority of medical students expect to practice medicine, but they are often unfitted for this end by their very training, owing to the undue emphasis laid on laboratory diagnosis and treatment, and the much reduced attention given to the training of their powers of observation and to the study of the patient. Conditions must be changed, since, unless the student is fortunate enough to supplement his medical school training by an internship under a good clinician instead of, as often happens, under a full time appointee who has never had any clinical experience outside of a hospital ward, he is obliged to enter practice, if in fact he dares to do so, with little practical training in the care of the patient and none in the humanities of medicine.

The medical course has been gradually lengthened in the last fifty years, first to three and then to four years, while in some institutions a fifth or hospital year is either required or is under consideration. In spite of this lengthening of the medical course the amount of time devoted to clinical subjects has been relatively curtailed, until an entirely disproportionate amount of time is devoted to the laboratory sciences, in the attempt to make them not an adjunct to the proper training of physicians but the predominating force in medical education.

The raising of medical standards should result in attracting a higher grade of men to the profession than formerly, as well as in turning out better equipped physicians, but in my judgment the student body of today is not of as high a grade as it was ten to fifteen years ago. Apparently the present system is dwarfing instead of developing the average student, the curtailment of the time allowed to the clinical courses resulting in the teaching of too much digested material instead of aiding him to develop by the study of patients under intelligent guidance.

Many of the ablest men in medicine today would find it impossible to enter a Class A medical school without returning to college to take a special course to meet the entrance requirements, and yet they are among the leaders of the profession. The required premedical course is of such a nature that unless a student decides relatively early in his college career to study medicine he cannot complete the required work without devoting at least an extra year to it, a sacrifice of time and money which many men cannot afford to make. Theoretically the premedical course should raise the standard in the medical school by eliminating the relatively unfit and the poorly educated. It does this to some extent, but it also eliminates many men who after careful and mature consideration arrive at the decision toward the end of their college course that they wish to study medicine. Many who are relatively unfit for the practice of medicine decide early that they wish to enter the medical profession and take the necessary courses which enable them to do so, while a considerable number of men who are in every way unusually well fitted for the profession are barred from it, unless they are able to devote one or two extra years to preparation, and these men have been in the past among the ablest students even without the preliminary course at present required and are today at the top of the profession. In addition the marks obtained in college are often the principal basis on which fitness to study medicine is judged, and thus the man of many interests during his college course who is distinctly a well-rounded man is often refused a chance to study for a profession for which he is superlatively well fitted, while a second-rate man who has devoted himself to obtaining high marks in his college courses is accepted. My own impression of the average medical class in our own school, which is supposedly handpicked from a large number of applicants, is that while there are few very poor men in the class, the number of men of outstanding ability is so small that the average is certainly no higher than it used to be and the general impression is one of distinct mediocrity.

My own experience, gained from teaching fourth year students and from dealing with house officers who come to us from various hospitals and medical schools, has convinced me that the students of today are not as well fitted to enter the practice of medicine as those of fifteen years ago. They have perhaps been taught more but have learned less. Their knowledge of the laboratory side of medicine is greater, but when it becomes a question of making a patient comfortable and of meeting the human problems that arise, they are singularly helpless and have little self-reliance.

I feel strongly that, in spite of the great increase in the cost of a medical education necessitated by the research and teaching laboratories, the results are meager. I do not wish to infer by this statement that I do not favor the maintenance of research laboratories in con-

nection with a medical school for the purpose of advancing medical progress in every way, or in any way grudge the expense involved, since I believe that future progress depends on a judicious cooperation between the clinical and research branches, but I do believe that the education of competent physicians to care for the needs of the community suffers when laboratory teaching dominates our medical schools at the expense of clinical training as at present. Less than 5 per cent of a class, according to recent figures, enter the research branches of medicine and yet the whole class must take an exhaustive training in laboratory work which so crowds out clinical training as to work a serious injustice to the 95 per cent or more who wish to practice medicine. Furthermore, a considerable number of men who might be useful and able physicians are dropped from the medical schools each year because they fail to reach the standard of laboratory excellence required, their fitness to continue their studies being judged by men who have never practiced medicine, and yet they are college trained men selected from a large number of candidates.

Before a proper balance can be restored and the study of medicine placed on a sane basis, the present undue importance given to the so-called fundamental sciences must be materially reduced, by which I mean that they must be so taught as to be an aid to the clinical training which is to follow, and not as if the end-result aimed at was to make every student a laboratory investigator. In other words, medical education should primarily serve the 95 per cent who hope to practice medicine instead of the 5 per cent who hope not to. Under modern conditions the great majority of medical students must depend on their postgraduate hospital training for much that should be taught in the medical schools in order that the 5 per cent may need less postgraduate training. The conditions should be reversed.

The great function of the medical schools used to be to train doctors to care for the sick and suffering in the community. The outstanding teachers were men of wide clinical experience who inspired the students by their teaching and example. Such of the medical sciences as were taught were included because they aided in the development of better doctors. With the development of new specialties it was realized that the student must be given some instruction in them, although the only adequate training was to be obtained by postgraduate study. The time to be devoted to the teaching of these specialties was obtained by lengthening the medical course from three to four years, but the four cardinal medical subjects, surgery, medicine, obstetrics, and pediatrics, were still taught by men of broad clinical experience and occupied the major portion of the course, supplemented by practical work in the out-patient departments and by a hospital internship later. With the increase in the laboratory branches of medicine more time had to be provided if the student was to receive



an up-to-date medical education. Since this could only be done by decreasing the time devoted to clinical instruction, it has been so arranged, and the community which pays the bills is the sufferer.

The great clinical teacher has either disappeared or his opportunities for teaching have been so curtailed that his efforts are largely in vain. The control of medical education has been taken over by the laboratory group who are always able to devote an indefinite amount of time to meetings and organization, and the influence of the clinical group in our medical schools is small. As a natural result the medical student of today receives an intensive training in the fundamental sciences, a fairly comprehensive course in laboratory medicine and research, a very minor training in the study of a patient as an individual and not as a test tube, and practically no instruction in the relief of suffering and in the humanities of medicine. This would be a good enough preparation if the primary object of medical training were to fit a man to do research or to practice entirely within a hospital, but it is a very poor training for a man who wishes to enter practice. It is a fortunate thing for the community that the students themselves realize that the training afforded by the medical schools has little practical bearing on the practice of medicine and that a prolonged training as intern and resident in properly equipped hospitals is absolutely necessary.

The increasing interest in research medicine has led to the establishment of full time teaching positions in various hospitals which are affiliated with medical schools. Theoretically a full time appointment should be ideal from the standpoint of research, the teaching of students, and the care of the patient. Practically, the patient suffers in most cases, because if a young man takes such a position, it means that he is interested primarily in research, and perhaps somewhat in teaching, but that he has had little or no experience in the care of the sick. He may be able to stimulate interest in the study of various medical problems and thus as an investigator add to the prestige of his hospital, but the patients under his charge and the students for whom he is responsible are less efficiently served than they would be by a less scientific man of greater clinical experience.

The ideal full time teacher is the man of wide interests and clinical experience outside the hospital, who elects a full time teaching position as offering the widest opportunity for good in the community as a fitting close to an active career, and not the untried man who is selected because of his interest in laboratory problems, and who is sufficiently mediocre to be satisfied with the salary of a second-rate man, provided he can be in a position sheltered from competition.

In many cases the full time teaching position is a menace instead of a benefit since it carries with it a prestige which is not warranted by the facts. Laboratory research is stimulated and therefore some in-

crease in the sum of human knowledge probably occurs, but the man who wishes to enter the practice of medicine should not have to depend for his training on teachers who have never had to face the problems which are met in private practice and who are not interested in them.

The curricula of our medical schools should be revised. The control of medical education should be not in the laboratories but in the fundamental clinical departments, surgery, medicine, obstetrics, and pediatrics. Such of the laboratory branches as are of direct aid to the study of medicine from a practical standpoint should be taught, and what should be taught in these sciences should be determined by the clinical group. If a man wishes a further education in physiology or biochemistry, he should take that as a postgraduate course, just as a man who wishes to take up clinical medicine takes an internship, and the amount of laboratory teaching should be cut down and placed on a practical basis. A considerable experience with students from our own and also from other schools leads me to believe that in physiology the attempt is made to train all students to become physiologists and not to instruct them in the application of physiology to practical medicine, and that a similar condition exists in other scientific branches. The time to be devoted to the cardinal clinical medical sciences should be increased to the limit and such time devoted to the teaching of specialties as is possible, with the understanding that no man can be educated as a specialist in the medical school. The clinical teacher should be a man of clinical experience and not a laboratory trained man who has never practiced, as is often the case. The scientific and clinical men should work side by side, and the student should be given a greatly increased training in the use of his powers of observation under the supervision of men who have been properly trained in clinical medicine, the laboratory methods of diagnosis only being employed after exhaustive study of the patient.

Most of us are teachers. Many of us realize the unsatisfactory state of medical education today. I believe that we, in conjunction with the other clinical societies, can accomplish most for the good of the community by a concerted effort to restore the teaching of clinical medicine and the fitting of men to enter practice to their proper position in medical education. The modern graduate may have been taught more but he has learned less than his predecessors. He is a poorer doctor and often hesitates to enter practice except under the ægis of a hospital, because he has had very little training in practical therapeutics and none at all in the humanities of medicine. As has been well said by one of the greatest exponents of modern medicine, it is more important to know what kind of a patient is suffering from a disease than what kind of a disease a patient is suffering from, a fact which has been entirely lost sight of in our medical schools.

# PLASMA PROTEIN FRACTIONS IN NORMAL PREGNANCY, LABOR, AND PUERPERIUM

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IN a previous communication from this laboratory,<sup>1</sup> we reported the total plasma protein variations occurring during normal pregnancy, labor, and puerperium, and constructed a curve showing the average protein content of the plasma at the various periods. This work showed that, "during normal pregnancy the plasma proteins begin to fall in the third lunar month, or occasionally even before that period, and decrease gradually to a minimum at the sixth month, after which there is a slow rise during the latter months of pregnancy with the values at the tenth month still somewhat below normal. A further sharp rise occurs at the time of labor and is continued into the first day postpartum, but in the next twenty-four hours the protein suffers an abrupt decrease, which is maintained for three or four days, and is followed by a rapid rise to normal at the end of the first week." Changes in the plasma volume percentage, as shown by hematocrit readings, were directly opposite to those of the plasma proteins, although of similar magnitude, and it was argued that, in all probability, the curve produced indicated "\* \* \* roughly the relative changes of plasma and blood volume occurring normally \* \* \* among pregnant women \* \* \*."

This determined reduction of the total plasma proteins during pregnancy confirmed the earlier observations of Zangemeister,<sup>2, 3</sup> Zangemeister and Meissl,<sup>4</sup> Eckelt,<sup>5</sup> Landsberg,<sup>6</sup> Dienst,<sup>7</sup> Rusznyák, Barát, and Kürthy,<sup>8</sup> Bergmann,<sup>9</sup> and Coetzee,<sup>10</sup> but disagreed with Fähræus,<sup>11</sup> who found the plasma proteins practically the same in five pregnant women (month of pregnancy not given) as in six normal men, and with Hafner,<sup>12</sup> who recently reported the total proteins definitely increased during gestation. This latter observer used a refractometric method of analysis and compared his results with what is apparently an arbitrary normal value, since he gives no figures for nonpregnant individuals. There is no reason to prefer this work to that done by chemical procedures, as Howe<sup>13</sup> seemingly has done, and, since this author stands quite alone in his position, it is fair to assume that his conclusions are incorrect, and that a reduced concentration of plasma proteins is quite characteristic of pregnancy. Lewinsky's<sup>14</sup> finding of a higher plasma protein in four pregnant women than in one nonpregnant individual needs hardly be considered because of the paucity of the observations.

The various protein fractions have been less studied during pregnancy and upon such small numbers of cases that conclusions cannot safely be drawn. Dienst,<sup>7</sup> Rusznyák, Barát, and Kürthy,<sup>8</sup> and Coetzee<sup>10</sup> have found the albumin somewhat reduced, although Lewinsky<sup>14</sup> reported a slight increase. Hafner<sup>12</sup> made no com-

parisons with nonpregnant women, but found the albumin slightly lower after delivery than before parturition.

Dienst,<sup>7</sup> Fähræus,<sup>11</sup> and Coetzee<sup>10</sup> found the globulin decreased during gestation, while Lewinsky<sup>14</sup> and Rusznyák, Barát, and Kürthy<sup>8</sup> have reported an increase, and Hafner<sup>12</sup> found a relative increase during pregnancy with a rapid drop in the postpartum period.

More uniformity of opinion exists concerning the fibrin (fibrinogen), which is said to be increased during gestation. Dienst,<sup>7</sup> Foster,<sup>15</sup> Gram,<sup>16</sup> Lewinsky,<sup>14</sup> Krösing,<sup>17</sup> Landsberg,<sup>6</sup> Rusznyák, Barát, and Kürthy,<sup>8</sup> Nasse,<sup>18</sup> de Wesselow,<sup>19</sup> and Coetzee<sup>10</sup> agree that in pregnancy the plasma fibrin is augmented. The majority of these authors found a gradual increase during pregnancy with the highest values at the time of labor, although Gram<sup>16</sup> reported his highest average at the eighth lunar month. Krösing's<sup>17</sup> figures would indicate a rather rapid fall during the early postpartum period.

Great variations are noted in the reported values for total proteins and for the different protein fractions in normal individuals, and it is quite evident that the results depend largely upon the method of analysis employed. Howe,<sup>13</sup> in a recent review, remarks: "The evaluation and correlation of the various observations to show absolute differences in the distribution of the plasma proteins is difficult because of the variety of procedures which have been used in their estimation with the accompanying variations in results." And later: "To single out definite values as representative of particular states, and especially the normal composition of the blood plasma, is exceedingly uncertain." It may be said, however, that normal total protein is usually reported to be between 7.0 and 8.0 gm. per 100 c.c., the albumin between 4.0 and 5.0 gm. per 100 c.c., and the globulin between 2.0 and 3.0 gm. per 100 c.c., with the latter representing 35 to 45 per cent of the total proteins. It would seem that only results obtained by the same analytical procedure should be compared strictly.

In the case of fibrin, more uniform results have been obtained and a figure of about 0.30 gm. per 100 c.c. may be looked upon as normal, although here again different methods give values which can best be compared among themselves.

#### EXPERIMENTAL

We have analyzed 314 plasmas of nonpregnant, pregnant, parturient, and puerperal women, as shown in Tables I, II, III, and IV. An attempt was made to have each group large enough so that individual variations might be compensated, but in the charts which follow (Charts I, II, III, and IV) such variations have been plotted in order that they may not be submerged beneath the average figures. The method of Wu<sup>20</sup> was followed throughout without change and every effort was made to keep conditions identical during the months necessary to complete the task. Occasionally, for no obvious reason, a series of analyses on a particular day, or during a longer period, gave results which disagreed considerably with those immediately preceding and following; such data were discarded. We were frequently unable to determine the reason for such disturbances, but believe that it would be unfair to include the results. A minimum of stasis was employed during the collection of the samples, since it has been

shown by Rowe<sup>21</sup> that obstruction to the venous return very quickly increases the proteins in the plasma.

For convenience, the total proteins, albumin, globulin, and fibrin are considered separately.

#### TOTAL PROTEINS

Table I and Chart 1 give the variations in the total plasma proteins in the various periods, and in the latter each individual determination is represented by a separate dot. In each group some of the specimens were outside of what we consider the limits of normal, but the general trend is well represented by the average (solid line).

TABLE I  
TOTAL PLASMA PROTEIN VARIATIONS DURING NORMAL PREGNANCY  
(PROTEINS IN GRAMS PER 100 C.C.)

DIAGNOSIS	NO. OF CASES	PLASMA PROTEIN PERCENTAGES	
		EXTREMES	AVERAGE
NORMAL, NONPREGNANT YOUNG WOMEN	15	6.96 - 7.78	7.42
Normal, pregnant, 4 to 8 weeks	18	6.32 - 8.27	7.22
“ “ 9 to 12 weeks	17	6.19 - 8.55	7.32
“ “ 13 to 16 weeks	15	6.79 - 7.82	7.31
“ “ 17 to 20 weeks	17	6.23 - 7.75	7.11
“ “ 21 to 24 weeks	15	6.32 - 7.74	7.00
“ “ 25 to 28 weeks	17	6.20 - 7.68	7.06
“ “ 29 to 32 weeks	15	6.29 - 7.71	7.01
“ “ 33 to 36 weeks	15	6.41 - 7.62	6.73
“ “ 37 to 40 weeks	15	6.06 - 7.40	7.03
NORMAL, PARTURIENT, AT END OF LABOR	15	6.45 - 7.98	7.18
Normal, puerperal, 1st day p.p.	15	6.37 - 7.64	6.98
“ “ 2nd day p.p.	15	5.98 - 7.51	6.84
“ “ 3rd day p.p.	17	6.56 - 7.68	7.25
“ “ 4th day p.p.	15	6.23 - 7.48	7.00
“ “ 5th day p.p.	15	6.24 - 7.72	7.21
“ “ 6th day p.p.	15	5.68 - 7.92	7.23
“ “ 7th day p.p.	15	6.65 - 7.97	7.30
“ “ 2nd week p.p.	18	6.09 - 8.06	7.21
“ “ 3rd week p.p.	15	6.81 - 7.93	7.37

This curve follows the same general course as that shown in our previous communication.<sup>1</sup> There is a gradual drop during pregnancy and the minimum is reached at the ninth lunar month (rather than at the sixth). The subsequent rise in the tenth month and again during labor parallels the earlier graph. The postpartum lowering is broken by a rise on the third day, which is apparently due entirely to an increase of globulin (see Chart III), and normal values are reached again during the third week after delivery. The lowest point in the entire curve, at the ninth month, represents a decrease of 9.3 per cent from the nonpregnant average, as compared with an approximate 10 per cent reduction previously noted.

The total plasma protein values are slightly higher by the Wu method than by the Kjeldahl procedure previously employed, the difference, according to our parallel determinations, being on the

Total Plasma Proteins During Pregnancy.

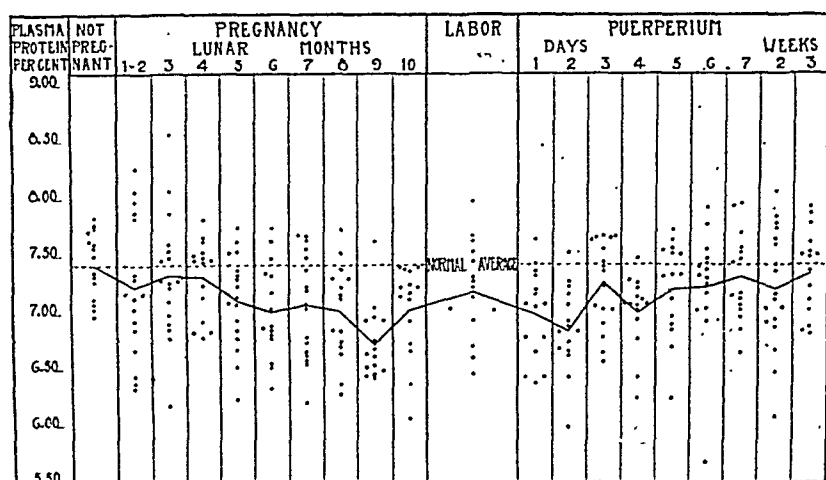


Chart I.

average 0.30 to 0.50 gm. per cent. Using the Wu method, Coetzee<sup>10</sup> reports an average for normal nonpregnant women of 8.05 per cent and Wu<sup>20</sup> gives a comparable figure for his normals. Our own aver-

Plasma Albumin During Pregnancy.

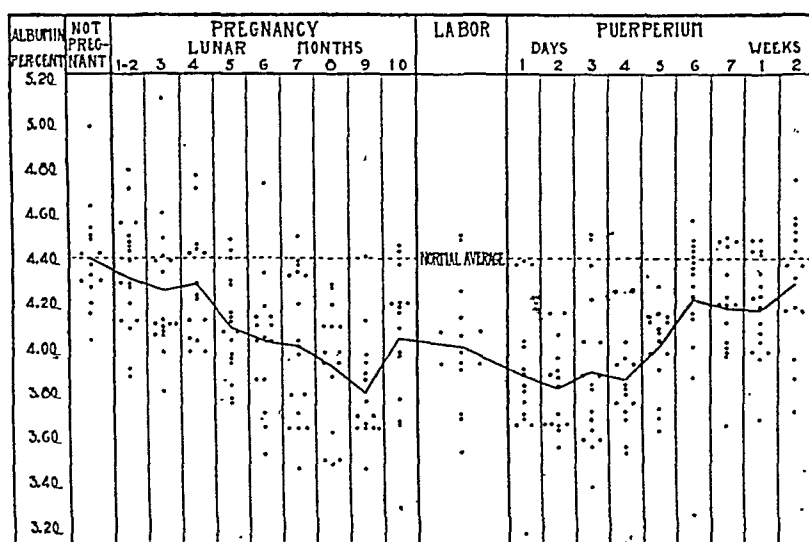


Chart II.

age of 7.42 per cent corresponds more closely to previously reported results obtained by the Kjeldahl method (Landsberg<sup>6</sup>—7.01 per cent; Dienst<sup>7</sup>—7.17 per cent; and Plass and Bogert<sup>1</sup>—7.04 per cent), and we, therefore, conclude that they are the more accurate. The only

explanation we can offer is that perhaps Coetzee and Wu neglected to draw the blood without any considerable venous stasis and so obtained values higher than they should. Some work now in progress shows that stasis very materially increases the concentration of all the protein elements, a fact which is not yet sufficiently appreciated.

#### SERUM ALBUMIN

Table II and Chart II give the determined values for serum albumin in the different periods. As in the total proteins, a considerable individual variation exists.

TABLE II  
SERUM ALBUMIN VARIATIONS DURING NORMAL PREGNANCY  
(ALBUMIN IN GRAMS PER 100 C.C.)

DIAGNOSIS	NO. OF CASES	SERUM ALBUMIN PERCENTAGES	
		EXTREMES	AVERAGE
NORMAL NONPREGNANT YOUNG WOMEN	15	4.06 - 5.02	4.42
Normal, pregnant, 4 to 8 weeks	18	3.90 - 4.74	4.34
“ “ 9 to 12 weeks	17	3.83 - 5.14	4.28
“ “ 13 to 16 weeks	15	4.01 - 4.80	4.31
“ “ 17 to 20 weeks	17	3.78 - 4.52	4.13
“ “ 21 to 24 weeks	15	3.55 - 4.76	4.06
“ “ 25 to 28 weeks	17	3.49 - 4.53	4.04
“ “ 29 to 32 weeks	15	3.51 - 4.31	3.95
“ “ 33 to 36 weeks	15	3.49 - 4.44	3.83
“ “ 37 to 40 weeks	15	3.33 - 4.49	4.07
NORMAL, PARTURIENT, AT END OF LABOR	15	3.56 - 4.53	4.04
Normal, puerperal, 1st day p.p.	15	3.20 - 4.42	3.91
“ “ 2nd day p.p.	15	3.58 - 4.18	3.85
“ “ 3rd day p.p.	17	3.41 - 4.54	3.94
“ “ 4th day p.p.	15	3.56 - 4.28	3.88
“ “ 5th day p.p.	15	3.67 - 4.31	4.04
“ “ 6th day p.p.	15	3.28 - 4.60	4.25
“ “ 7th day p.p.	15	3.68 - 4.53	4.22
“ “ 2nd week p.p.	18	3.73 - 4.53	4.21
“ “ 3rd week p.p.	15	3.75 - 4.78	4.33

Chart II is drawn to a somewhat larger vertical scale than is Chart I so that the variations appear more marked. As a matter of fact, the percentage changes are slightly greater than in the case of the total proteins, the lowest point (3.83 gm. per 100 c.c.) at the ninth month being 13.5 per cent lower than the normal nonpregnant average.

These results in general confirm the work of previous investigators that the serum albumin is lowered during pregnancy, and substantiate Hafner's<sup>12</sup> findings that the albumin is lower postpartum than immediately antepartum. In the 15 nonpregnant women, the albumin represents 59.6 per cent of the total proteins, whereas, at its lowest point in the ninth lunar month, it accounts for 56.9 per cent of the protein,—a change of only 2.7 per cent.

## SERUM GLOBULIN

Our serum globulin findings are reported in Table III and are graphically recorded in Chart III, drawn to the same scale as Chart II.

TABLE III  
SERUM GLOBULIN VARIATIONS DURING NORMAL PREGNANCY  
(GLOBULIN IN GRAMS PER 100 C.C.)

DIAGNOSIS	NO. OF CASES	SERUM GLOBULIN PERCENTAGES	
		EXTREMES	AVERAGE
NORMAL NONPREGNANT YOUNG WOMEN	15	2.32 - 3.07	2.69
Normal, pregnant, 4 to 8 weeks	18	1.89 - 3.58	2.57
“ “ 9 to 12 weeks	17	2.09 - 3.55	2.71
“ “ 13 to 16 weeks	15	2.04 - 3.07	2.63
“ “ 17 to 20 weeks	17	2.12 - 3.05	2.59
“ “ 21 to 24 weeks	15	2.09 - 3.70	2.59
“ “ 25 to 28 weeks	17	2.04 - 3.35	2.66
“ “ 29 to 32 weeks	15	2.42 - 3.38	2.68
“ “ 33 to 36 weeks	15	2.14 - 2.92	2.53
“ “ 37 to 40 weeks	15	2.12 - 3.07	2.52
NORMAL, PARTURIENT, AT END OF LABOR	15	2.24 - 3.15	2.71
Normal, puerperal, 1st day p.p.	15	2.01 - 3.02	2.53
“ “ 2nd day p.p.	15	2.02 - 3.02	2.55
“ “ 3rd day p.p.	17	2.27 - 3.50	2.82
“ “ 4th day p.p.	15	2.12 - 2.97	2.67
“ “ 5th day p.p.	15	2.24 - 3.05	2.70
“ “ 6th day p.p.	15	2.07 - 2.95	2.54
“ “ 7th day p.p.	15	2.32 - 3.45	2.64
“ “ 2nd week p.p.	18	2.04 - 3.02	2.60
“ “ 3rd week p.p.	15	2.17 - 3.17	2.68

The curve of average serum-globulin content of the plasma (Chart III) shows no really significant variations from normal. Its lowest point (2.52 gm. per 100 c.c.) at the tenth month is 6.3 per cent below

Plasma Globulin During Pregnancy.

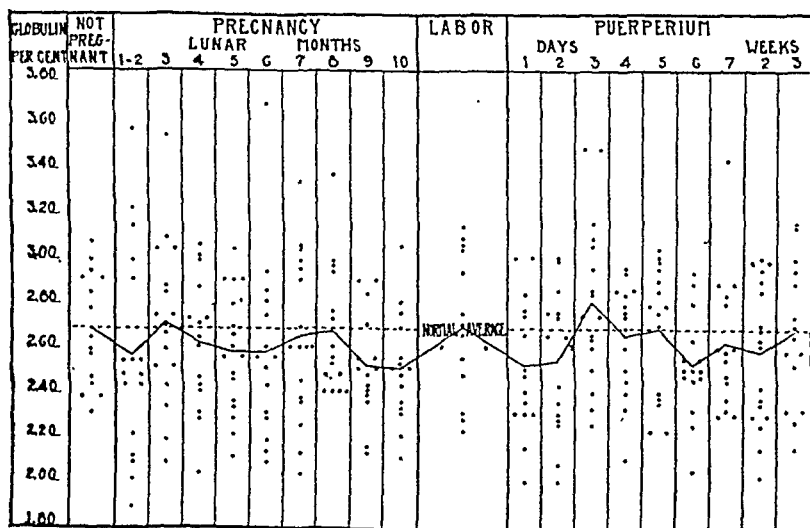


Chart III.



the average normal, while the highest point (2.82 gm. per 100 c.c.) on the third day after delivery is 4.8 per cent higher. As plotted, the separate determinations have a great tendency to scatter, representing a great individual variation in the globulin fraction. Our findings fail to confirm those of previous investigators in that they show no definite change in the serum globulin due to pregnancy. At the eighth month, the globulin represents 37.6 per cent of the total protein, whereas in nonpregnant women it represents 36.2 per cent, an increase during pregnancy of only 1.4 per cent.

Table IV and Chart IV present the changes in the plasma fibrin at the corresponding periods of the reproductive cycle.

TABLE IV  
PLASMA FIBRIN VARIATIONS DURING NORMAL PREGNANCY  
(FIBRIN IN GRAMS PER 100 C.C.)

DIAGNOSIS	NO. OF CASES	PLASMA FIBRIN PERCENTAGES	
		EXTREMES	AVERAGE
NORMAL NONPREGNANT YOUNG WOMEN	15	0.23 - 0.40	0.31
Normal, pregnant, 4 to 8 weeks	18	0.26 - 0.37	0.31
" " 9 to 12 weeks	17	0.27 - 0.41	0.33
" " 13 to 16 weeks	15	0.28 - 0.46	0.37
" " 17 to 20 weeks	17	0.29 - 0.52	0.39
" " 21 to 24 weeks	15	0.28 - 0.46	0.37
" " 25 to 28 weeks	17	0.28 - 0.50	0.37
" " 29 to 32 weeks	15	0.27 - 0.50	0.37
" " 33 to 36 weeks	15	0.28 - 0.46	0.37
" " 37 to 40 weeks	15	0.37 - 0.52	0.44
NORMAL, PARTURIENT, AT END OF LABOR	15	0.32 - 0.64	0.44
Normal, puerperal, 1st day p.p.	15	0.35 - 0.65	0.46
" " 2nd day p.p.	15	0.29 - 0.60	0.44
" " 3rd day p.p.	17	0.30 - 0.62	0.49
" " 4th day p.p.	15	0.35 - 0.62	0.45
" " 5th day p.p.	15	0.32 - 0.62	0.47
" " 6th day p.p.	15	0.31 - 0.56	0.44
" " 7th day p.p.	15	0.30 - 0.59	0.44
" " 2nd week p.p.	18	0.30 - 0.59	0.40
" " 3rd week p.p.	15	0.27 - 0.60	0.36

The plasma fibrin curve in Chart IV confirms in general the reports by previous authors of a fibrin increase during pregnancy, but differs somewhat from their results. During the third and fourth months the fibrin rises to a level of 0.37 gm. per 100 c.c., where it remains quite constant until the tenth month when another increase begins and persists until the third day postpartum, after which the curve slowly falls toward normal.

Calculations of the average whole-blood fibrin, as recommended by Foster and Whipple,<sup>22</sup> from the plasma fibrin values and the plasma volume per cent (hematocrit readings), are found in Table V.

The plasma volume percentage tends to increase in the course of

gestation, as does the plasma fibrin, so that the whole-blood fibrin shows a greater proportional variation than does the plasma fibrin.

Calculations of the percentages of the total plasma protein represented by the serum albumin, serum globulin, and plasma fibrin are presented in Table VI.

Plasma Fibrin During Pregnancy.

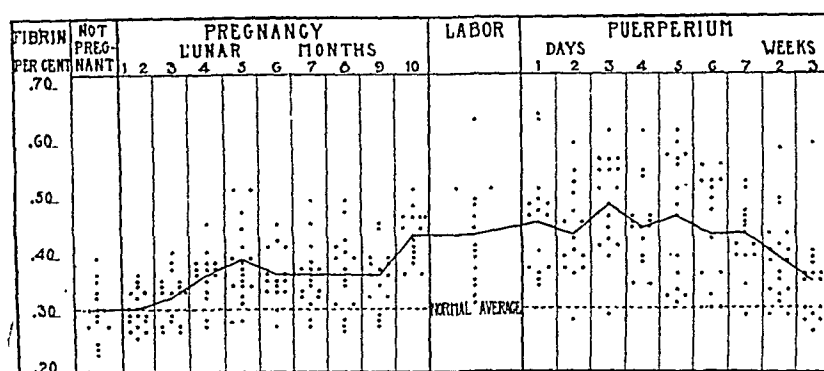


Chart IV.

There is a tendency for the more easily precipitable proteins, the globulin and fibrin, to increase at the expense of the albumin, but at no time during pregnancy is this change very marked, and the uniformity between the protein fractions at the different periods is

TABLE V  
WHOLE BLOOD FIBRIN VARIATIONS DURING PREGNANCY  
(FIBRIN IN GRAMS PER 100 C.C.)

DIAGNOSIS	NO. OF CASES	PLASMA VOLUME, PER CENT	FIBRIN	
			PLASMA	WHOLE BLOOD
NORMAL NONPREGNANT YOUNG WOMEN	15	65.7	0.31	0.20
Normal, pregnant, 4 to 8 weeks	18	63.3	0.31	0.20
" " 9 to 12 weeks	17	65.7	0.33	0.22
" " 13 to 16 weeks	15	67.2	0.37	0.25
" " 17 to 20 weeks	17	66.9	0.39	0.26
" " 21 to 24 weeks	15	69.3	0.37	0.26
" " 25 to 28 weeks	17	69.2	0.37	0.26
" " 29 to 32 weeks	15	68.7	0.37	0.25
" " 33 to 36 weeks	15	67.9	0.37	0.25
" " 37 to 40 weeks	15	68.4	0.44	0.30
NORMAL, PARTURIENT, AT END OF LABOR	15	66.2	0.44	0.29
Normal, puerperal, 1st day p.p.	15	67.4	0.46	0.31
" " 2nd day p.p.	15	70.1	0.44	0.31
" " 3rd day p.p.	17	69.9	0.49	0.34
" " 4th day p.p.	15	66.3	0.45	0.30
" " 5th day p.p.	15	66.1	0.47	0.31
" " 6th day p.p.	15	65.4	0.44	0.29
" " 7th day p.p.	15	68.1	0.44	0.30
" " 2nd week p.p.	18	64.8	0.40	0.26
" " 3rd week p.p.	15	66.2	0.36	0.24

perhaps the most noteworthy thing to be gained from Table VI. The fibrin shows the greatest percentage increase, and at its highest point is more than one and one-half times as abundant proportionately as in the nonpregnant woman.

TABLE VI

VARIATIONS IN SERUM ALBUMIN, SERUM GLOBULIN, AND FIBRIN PERCENTAGES OF TOTAL PLASMA PROTEINS DURING NORMAL PREGNANCY

DIAGNOSIS	NO. OF CASES	PERCENTAGE OF TOTAL PROTEIN		
		ALBUMIN PER CENT	GLOBULIN PER CENT	FIBRIN PER CENT
NORMAL NONPREGNANT YOUNG WOMEN	15	59.6	36.2	4.2
Normal, pregnant, 4 to 8 weeks	18	60.1	35.6	4.3
“ “ 9 to 12 weeks	17	58.5	37.0	4.5
“ “ 13 to 16 weeks	15	58.9	36.0	5.1
“ “ 17 to 20 weeks	17	58.1	36.4	5.5
“ “ 21 to 24 weeks	15	57.8	36.4	5.5
“ “ 25 to 28 weeks	17	57.2	37.6	5.2
“ “ 29 to 32 weeks	15	56.4	38.3	5.3
“ “ 33 to 36 weeks	15	56.9	37.6	5.5
“ “ 37 to 40 weeks	15	57.9	37.7	6.3
NORMAL, PARTURIENT, AT END OF LABOR	15	56.2	37.7	6.1
Normal, puerperal, 1st day p.p.	15	57.4	36.2	6.6
“ “ 2nd day p.p.	15	56.3	37.3	6.4
“ “ 3rd day p.p.	17	54.3	38.9	6.8
“ “ 4th day p.p.	15	55.5	38.1	6.4
“ “ 5th day p.p.	15	56.0	37.5	6.5
“ “ 6th day p.p.	15	58.8	35.1	6.1
“ “ 7th day p.p.	15	57.8	36.2	6.0
“ “ 2nd week p.p.	18	58.4	36.1	5.5
“ “ 3rd week p.p.	15	58.8	36.3	4.9

## DISCUSSION

The decrease in total plasma proteins during pregnancy was, in our earlier communication, considered as being due to a watery dilution of the blood, and, in view of the evidence supporting that opinion, we are not inclined to change our position. The absolute increase in fibrin and the slight relative increase of globulin agree well with such a dilution hypothesis, since these proteins probably have a greater hydration capacity than the albumin, the fibrin being particularly potent in this direction. Gram<sup>10</sup> believes that the fibrin increase in pregnancy is due to a mild irritation of the liver, but the evidence favoring a disturbance of hepatic function during gestation is so insecure that we prefer not to agree with such an explanation. The whole question of the formation of the plasma proteins is still so unsettled (Howe<sup>12</sup>) that it is quite impossible to make any definite statements.

It is, however, of considerable interest that the fibrin, which is so much concerned in coagulation of blood, shows a marked increase

during pregnancy, and especially during the last month, seemingly in preparation for the act of delivery, when a certain blood loss is inevitable, and when prolonged or profuse bleeding might well be fatal. The phenomenon may be regarded as a protective mechanism designed to prevent excessive hemorrhage even though the actual cause of its occurrence may not be known.

The postpartum increase of fibrin is explained by Foster<sup>15</sup> as being due most probably to trauma incident to birth, when the birth canal is inevitably injured to some extent. Foster and Whipple<sup>22</sup> have also shown that hemorrhage leads to a fibrin increase, and the blood loss

Plasma Fibrin and Sedimentation Time.

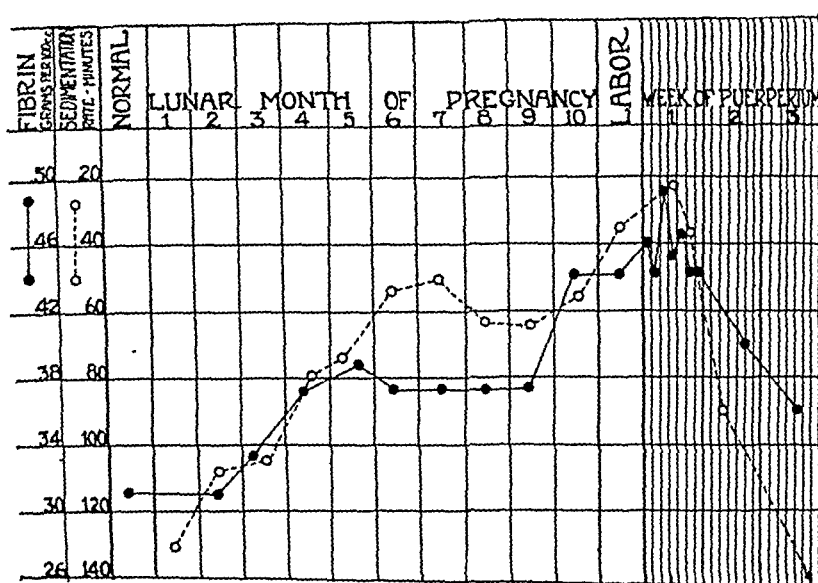


Chart V.

at delivery and during the first few days after delivery may well be factors in the puerperal rise.

Colostrum is particularly rich in globulin, which suggests that the unusually high globulin average on the third day of the puerperal period may perhaps be due to the onset of mammary gland activity, when the secretion of colostrum is especially abundant.

The increased sinking velocity of the red blood cells (Linsenmeier<sup>23</sup>), or the decreased suspension stability of the blood (Fåhræus<sup>11</sup>), during pregnancy has recently received considerable attention. The majority of observers have noted the relation of an increased fibrin content of the plasma to this phenomenon, although some have considered that a rise in the globulin fraction may also be of significance. We have found the globulin to remain practically constant during pregnancy and the postpartum period, whereas the fibrin shows a rise and later fall, which conforms well with the curve

for sedimentation rate that can be constructed from the values given by Linzenmeier.<sup>23</sup> Chart V combines the curves and demonstrates their remarkable similarity.

Undoubtedly, the viscosity and surface tension of the plasma also vary with the quantitative changes in the proteins, but the available data are too few to permit of accurate comparison.

It was thought originally that perhaps changes in the plasma fibrin and globulin, which are supposedly the more hydrophilic blood proteins, might explain the hydroplasmia during pregnancy. The slight relative increase in globulin is probably negligible, but the curves for fibrin and for plasma volume percentage, which is considered an index of plasma dilution, are so generally similar that the idea cannot be entirely abandoned, although it seems that other factors must also be active. In this connection, it is planned to study the acid-base balance in the plasma after the cumulative fashion employed in this and preceding papers. Very slight changes in the hydrogen-ion concentration in the plasma would affect appreciably the hydration capacity of the proteins, and perhaps thus explain the watery dilution of the blood, which is a part of normal pregnancy, and which is even more evident in the toxemias of late pregnancy.

#### SUMMARY

A cumulative study has been made of the various protein fractions in the blood plasma of normal nonpregnant, pregnant, parturient, and puerperal women, using the Wu method of analysis. It was hoped to relate the changes in some one fraction, globulin or fibrin particularly, with the changes in watery dilution of the blood during the reproductive cycle. The curve developed for fibrin corresponds rather closely with that for plasma volume percentage, and it is suggested that perhaps the dilution of the plasma may be directly related to the increase of fibrin, although it is thought that other factors may have a rôle. The cause of the fibrin increase is admitted to be unknown, but not much consideration is given to the idea that it may be the result of a mild gestational injury to the liver. The accurate relationship between the rise in fibrin and the increased sedimentation rate of the blood cells, in the absence of any similar changes in the globulin fraction, leads us to agree with those who believe that the latter is the result of the former, the increased agglutination of the red cells into rouleaux being an intermediate and necessary stage for the increase in sinking velocity. There is a rise of globulin on the third day after delivery which may be directly associated with the onset of milk secretion.

## CONCLUSIONS

1. The total plasma-proteins tend to be diminished during pregnancy and the early part of the puerperium.
2. The serum-albumin is diminished to such an extent that the fall of total proteins can be attributed to the reduction in concentration of this fraction. The relative decrease is slight.
3. The serum-globulin undergoes a slight relative increase, although the absolute values remain practically constant.
4. The fibrin (fibrinogen) rises during pregnancy to reach a high point shortly after delivery. The relative increase is greater than the absolute change.

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## THE DIFFERENTIAL DIAGNOSIS BETWEEN DIABETIC AND NONDIABETIC GLYCOSURIAS IN PREGNANCY\*

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THE necessity of distinguishing between diabetes mellitus and the more harmless glycosurias is always definite, and especially in pregnancy, where the possibilities for misfortune are so great in the event of diabetes not being recognized. During pregnancy, this distinction is sometimes very difficult. It was hoped that perhaps more information could be gained by reviewing cases of glycosuria of all origins, after a final classification. It is admitted that the final decision was not made in all cases without the lapse of time, in some instances not until after a succeeding pregnancy. The proved series is not large, but it may well form the basis for future work. Out of a total of 24 cases of glycosuria there were obtained for study, eight cases of diabetes and seven of glycosuria.

The diabetic cases usually offered less trouble in recognition than the nondiabetic glycosurias and are presented not only as a datum point to the consideration of the others, but also as having interest as examples of diabetes complicating pregnancy. As there is a possibility that the reader, applying his own criteria, may not agree with the final diagnosis, the cases are given in some detail.

The first diabetic patient was thirty-nine years old, at term in her seventh pregnancy. All previous pregnancies and deliveries had been normal. She was seen on March 20, 1921, the day after delivery, which had occurred about a month prematurely. She gave a history of edema of the legs for some days before labor, and for

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a day or two, nausea and vomiting. On March 13, glycosuria had been found. On March 20, there was marked glycosuria, with a positive ferric chloride reaction in the urine. The patient had livid lips and finger tips, and was hyperpneic. Alveolar  $\text{CO}_2$  tension (Marriott) was 35 mm. Treatment was largely by forced intake of fluids and low carbohydrate diet. On March 28, after the acidosis had subsided, the blood sugar was 109 mg. per 100 c.c., one and a half hours after breakfast. The patient went home April 3, in good condition, on appropriate diet.

On March 19, 1923, the patient was readmitted in coma. She was given the 100 units of insulin available and restored to consciousness. Lobar pneumonia was then discovered. The patient lapsed again into coma, after a few hours, and died.

The *second* case was that of a woman of thirty, seen on February 28, 1922. Quickening had occurred on October 17, 1921. Sugar was found in the urine on February 28. Her mother and one brother had died of diabetes. Previous to the present pregnancy, in January, 1921, glycosuria was observed. Three previous pregnancies had ended in miscarriage. The patient was grossly overweight before the present pregnancy.

She was given a low carbohydrate diet and it was decided that, if pregnancy continued until the eighth month, to induce labor, as the surest method of getting a living baby.

On March 2, the urine showed a positive ferric chloride test, with alveolar  $\text{CO}_2$  tension of 35 mm. Labor was induced on March 3, with resulting normal delivery. On March 7, the fasting blood sugar was 112 mg. On March 14, the blood sugar, one and a half hours after breakfast, was 122 mg., and, on March 23, 130 mg. In March, 1926, the patient was in good condition, taking care with her diet. The baby was doing well.

The *third* case occurred in an enormously fat woman of twenty-four, seen on April 18, 1924, because of pruritus vulvae and threatened abortion. In 1917 and 1918 glycosuria had been found. She had aborted at two months in 1917. In 1921, she had been delivered of a stillborn, full-term fetus. Since then, she had had four miscarriages. When seen, there was slight vaginal bleeding, with about a two months' pregnancy. On April 19, the fasting blood sugar was 204 mg. The patient aborted on April 19. Up to October, 1924, on restricted diet, she was free from glycosuria, and lost some weight, but another miscarriage occurred then.

The *fourth* diabetic case was that of a woman of twenty-seven, admitted on November 17, 1924, because of glycosuria. For eight years she had had pruritus vulvae. She had lost 25 pounds of weight during the year. She had been pregnant nine times, with four children living. She had had two miscarriages and one stillbirth. There was no family history of diabetes.

The patient was three and one-half months pregnant. Glycosuria without ketonuria was found, after admittance. The fasting blood sugar was 200 mg. After instruction as to diet, the use of insulin and the testing of urine, the patient was discharged to Out-Patient observation on December 3, 1924. Readmission occurred on February 2, 1925, because of marked glycosuria and weakness, following a heavy cold. At this time, the fasting blood sugar was 370 mg. During this period of observation it was noted that diacetic acid was apt to be found in the urine, although sugar was absent. On February 11, 1925, she was discharged to the Out-Patient department.

Final admission on March 9. No glycosuria. The fasting blood sugar was 113 mg. A steadily increasing ketonuria was present, not controllable by increase of carbohydrate in the diet and greater dosage of insulin. On March 19, the fasting



blood sugar was 101 mg., and 94 mg. on April 2. On April 10, labor was induced, about a month before term, because of apparently impending fetal death. As a preliminary to labor, rectal instillations of glucose solution, with appropriate amounts of insulin were given subcutaneously. Labor was normal, and after delivery, ketonuria disappeared rapidly, and food tolerance rose greatly. Mother and baby were discharged in good condition on April 24, 1925.

The *fifth* case occurred in a primigravida of twenty-eight, admitted on May 23, 1923, because of glycosuria. There had been no symptoms suggesting complications. Blood sugar, three hours after breakfast, was 168 mg. On appropriate diet, the glycosuria disappeared, and on May 25, the fasting blood sugar was 98 mg. The patient was discharged to follow the diet at home. When readmitted in labor on August 8, she stated that glycosuria had been found frequently. She was delivered of twins on August 9. On discharge, she was sugar free. On April 3, 1924, she was readmitted to the medical service with the history of a gradual loss of weight over three months, and polyuria and thirst for one month. There had been no restriction of diet. Sugar had been found in the urine two days before admission. The subsequent course of this patient has been that of a diabetic, requiring a moderate amount of insulin to utilize carbohydrates, with two attacks of acidosis, induced by acute respiratory infections.

The *sixth* case of this group occurred in a woman of thirty-three, admitted on December 26, 1924, two and a half months pregnant. She had been pregnant three times before, the third pregnancy ending in a stillbirth, in August, 1921. Glycosuria had been found immediately after this delivery. Four months before admission, pruritus vulvae had developed, but had been relieved by diet. Her father had died of diabetes mellitus. Glycosuria was found after admission. The fasting blood sugar was 160 mg. After treatment and instruction, the patient was discharged on January 6, 1925.

She was readmitted on February 5, with vaginal bleeding, which had begun two hours before. She stated that she had found sugar in the urine on only two days since discharge. During this stay, no glycosuria was detected, and on February 12, the fasting blood sugar was 84 mg. She was again discharged on February 14.

On June 16, she was admitted in labor and was delivered normally. Her food tolerance increased after delivery, and for three months she was able to nurse her baby. Since weaning the child, she has been able to get along quite well without insulin.

The *seventh* diabetic case was in a woman of twenty-eight, pregnant at term for the third time, seen on January 21, 1920. The two previous pregnancies had been entirely normal. The patient's mother and two of her mother's sisters were diabetic. The patient was delivered on the day of admission, after precipitous labor. Glycosuria was absent on admission and on the following day, but was found on January 23. A glucose tolerance test on January 24, gave this result: Blood sugar, fasting, 180 mg.; one hour after taking 75 gm. glucose, 540 mg.; two hours after glucose, 320 mg.

After instituting diet, the patient remained sugar free until discharge on February 10. On March 5, blood sugar two and a half hours after a meal was 240 mg. After further readjustment of diet, no sugar was found in the urine until May 4. The patient then dropped from sight.

The *last* diabetic case, a primigravida of twenty-seven, was admitted on January 17, 1921, about eight months pregnant. Menstruation always irregular, with intervals varying from six weeks to four months. She was apt to have severe nosebleeds during the longer periods of amenorrhea. The patient was somewhat obese, with a

florid complexion. Blood pressure was 180/114. Glycosuria was present. The blood total nonprotein nitrogen was 36 mg., and blood sugar, fasting, 125 mg. After treatment and instruction, she went home.

Readmission on February 17. The patient then looked ill. Blood pressure was 170/108; the heart sounds were weak. There was marked edema of the legs; also retinal edema. About two hours after admission, she sustained a short clonic convulsion, so that delivery was promptly undertaken. The fetus was dead. Following delivery, the patient recovered so that by March 4, the day of discharge, the blood pressure was 134/90. Sugar occurred in the urine on February 28, only.

The later history of this patient is that as long as she kept to her diet, no glycosuria appeared. A miscarriage at six weeks took place in December, 1921. In November, 1922, she had not lost weight. Her blood pressure was 182/110, and blood sugar one and a half hours after a meal was 150 mg.

The next series of cases is made up of the nondiabetic group, of which the *first* occurred in a woman of twenty-six, pregnant for the fifth time, admitted on December 14, 1921. Three children were living. She had had no miscarriage. No glycosuria during these pregnancies. On December 12, glycosuria had been found by the Out-Patient staff. She had no thirst, polyuria, or increased appetite. On full diet, the glycosuria test varied (over several days) from none to a heavy reduction. On December 17, the fasting blood sugar was 169 mg., and 250 mg., two hours after breakfast. On December 20, with reduced diet, the blood sugar was 162 mg. She was discharged on a restricted diet, on December 21. On February 3, 1922, she was readmitted in labor, and was delivered and recovered normally, except that in two days, a slight sugar reduction was found.

On December 8, 1925, the patient was again admitted, pregnant, with blood pressure 195/130, with edema of the feet, albuminuria, and with hyaline casts in the urine. The blood nonprotein nitrogen was 29 mg., and the fasting blood sugar, 64 mg. on December 10. Glycosuria had not been found during antenatal observation. Spontaneous delivery took place on December 22. Discharge was on January 5, 1926, with blood pressure 130/80. Glycosuria did not appear throughout this period of observation.

The *second* case of glycosuria was that of a single woman of twenty-four, admitted in labor after her first pregnancy on January 3, 1922. She had no knowledge of previous glycosuria. The pregnancy had been normal. The blood Wassermann was strongly positive. Glycosuria was found on admission. Labor was long, and the fetus stillborn and premature. On January 7, blood sugar one hour and a half after breakfast was 175 mg. After January 4, when glycosuria was found for the second time, no sugar was detected in the urine up to discharge on January 22. In April, 1925, the patient was quite well, and putting on much weight, it is stated by her doctor.

The *third* glycosuria case occurred in a woman of twenty-seven, admitted in labor at term of her second pregnancy, on June 9, 1923. The first pregnancy had been normal. At the fifth month of the second pregnancy abortion was threatened. Shortly after this, glycosuria had appeared. The fasting blood sugar had been determined then as 95 mg. Delivery of a dead fetus was accomplished on June 9. No glycosuria was found during the puerperium. The patient was discharged on June 29.

In 1924, she suffered considerably from maxillary disease. In March, 1926, delivery occurred, after her third pregnancy, which had been normal to within five days before delivery. At this time, blood pressure had risen to 180/110, and, as no improvement in symptoms occurred under treatment, labor was induced. After deliv-

ery, recovery was rapid. No glycosuria was found during this period of observation nor, it should be stated, during the time between the second and third pregnancies.

The *fourth* case was that of a woman of thirty-eight, pregnant for the first time, admitted on March 22, 1923. Quickening had occurred November 30, 1922. Some seventeen years before, she had had much upper respiratory trouble and otitis media, with albuminuria.

The patient complained of headache; there was edema of the feet and hands. The heart was not enlarged, but was rapid (100). An aortic systolic murmur was present. Retinal edema was noted. The urine was negative.

On March 30, glycosuria was found, and frequently but not constantly thereafter, until April 8. After April 8 until discharge on May 10, no glycosuria appeared. On April 6, the fasting blood sugar was 139 mg. The patient was delivered by cesarean section, because of the cardiac condition on April 30. The baby died. On July 24, and August 14, no sugar was present in the urine.

On September 25, 1924, the patient was again delivered by cesarean section. During this pregnancy and puerperium, no glycosuria occurred.

The *fifth* case of nondiabetic glycosuria was very interesting. The patient, thirty-eight years old, was admitted in her third pregnancy on May 27, 1924, because of glycosuria. Her two other pregnancies had been normal. Three weeks before entry, pain over the pubes developed; increased frequency of urination with burning and pain had been present throughout pregnancy. About the seventh week of this pregnancy, the patient had had several furuncles on her back. These healed rapidly and did not recur. Epistaxis had been frequent during this pregnancy. For some weeks before admission, the patient had been salivated. Quickening was felt May 13.

The ptialism was marked. Three examinations of urine on the day of admission showed sugar. Glycosuria was present also the next day but, except on June 5 and 8, was absent until discharge on June 11. On May 28, the fasting blood sugar was 83 mg.; on May 29, 69 mg. The patient had been given atropin (grain  $\frac{1}{400}$ ) three times on May 28. This drug was then given twice each day from May 29 until June 2, on which day but one dose was given. On June 6, fasting blood sugar was 80 mg. Salivation had ceased on discharge.

Later observation showed that on liberal diet, there was no glycosuria, up to August 5. The effect of ptialism on food intake may have had some influence in this case.

The *sixth* case was a primigravida of thirty-three, admitted on April 10, 1921. Quickening noted on December 18, 1920. There had been much vomiting throughout pregnancy. Edema of the legs present during the later months. No abnormal urinary findings. Normal delivery April 10. On April 12, glycosuria was detected, persisting till April 15, after which none appeared. On April 13, fasting blood sugar was 120 mg. Discharged April 15.

A normal delivery in July, 1922, after a pregnancy characterized by marked edema. During the pregnancy, no glycosuria was found, but on the fifth day of this puerperium, a slight sugar reduction was noted. After this, there was no urinary abnormality up to March, 1926.

The *last* of the glycosuria cases was a woman of thirty-three, admitted in her first pregnancy on November 21, 1922. Term was estimated as January 13, 1923. Pregnancy had been normal until two days before entry, when the patient had vomited. She had been thirsty for some days and had noticed pruritus vulvae.

A heavy glycosuria was found upon admission. On November 14, the fasting

blood sugar was 45 mg., and 68 mg., one and a half hours after breakfast. The urine, however, was negative on November 14, and remained so until discharge on December 29.

A comparison of these two groups of cases shows very definitely that it is impossible to divide sharply the diabetic from the nondiabetic patient, whether by history, physical status or blood-sugar reactions. The passing of time seems to be the final diagnostic factor.

Included in the second group are examples of nondiabetic glycosuria, with a temporarily (at least) high blood sugar, and of glycosuria with low blood sugar. It may be that the type with hyperglycemia is not very familiarly known, for the literature reviewed includes but one mention<sup>1</sup> of this.

It is obvious, as Schenck remarks, that extreme caution must be used in the treatment of these cases, and that it is wisest to treat them as diabetic, until observation shows them to be nondiabetic.

Hypoglycemia seems to be harmless, yet there is a certain deceiving sound of finality to the expression "renal glycosuria." Since, as a matter of fact, we know little about the origin of this type, "of unknown origin" would seem to be a better characterization. At least, a confession of ignorance may tend toward carefulness.

NOTE.—It is the habit to subject urine, found for the first time to contain sugar, to both fermentation and phenylhydrazine tests. In all the cases under present discussion, glucose was found as the reducing body.

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22 PLEASANT STREET.

## INJURY OF THE CERVIX UTERI AND ITS INTERMEDIATE REPAIR

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PROBABLY no part of the body is as consistently neglected surgically as the cervix uteri following injury in the process of labor. Indeed, any recent laceration elsewhere in the body is a recognized indication for surgical treatment, whereas, in most instances, the cervix receives none.

This inconsistency in surgical judgment is difficult to explain. It may be in part due to the noncommittal attitude of the authors of textbooks on obstetrics, who advise suture of cervical lacerations only in case of hemorrhage. Occasionally, there will be found in textbooks recognition of individuals who have recommended surgical care of one kind or another, but support of these recommendations is lacking.

Again, the medical schools do not impress in their teaching the advisability of repair until after the pathology has caused the patient symptoms for which she seeks relief. Many of their students are graduated without the realization of the amount of pathology present in the average cervix following parturition. Unfortunately many who practice obstetrics never really know, because of a failure to perform thorough postpartum examinations. This, I believe, is less a matter of willful or intentional neglect than it is the result of faulty teaching, custom or habit.

Then, too, there may be those who, following examination and the discovery of injury, hesitate to admit to their patients the presence of "tears" for fear of criticism, for often "tears" are considered by the laity the result of improper care. It may take some time for the pendulum of public opinion to swing to the point where no surgeon will be held responsible for getting lacerations, but all surgeons will be held responsible for neglecting their repair.

Gynecologists are often called upon to relieve morbidity and distressing symptoms referable to lacerations of the cervix of longer or shorter duration. The patient complains of general disability dating from the birth of her baby; often there is an irritating leucorrhea; backache persists; there is heaviness from the congested pelvis; the uterus remains subinvolved; there may be history of repeated spontaneous abortions following the first pregnancy; possible sterility;

and, last but by no means least, symptoms of malignancy which are superimposed upon the pathology for which the cervical laceration presumably was responsible. Many carcinomata of the cervix are based upon old cervical tears.

In a study of two hundred recent deliveries, eighty-six per cent of all cases have cervical laceration; eighty-five per cent of these were bilateral. The record shows also that eighty per cent of all primiparae have cervical injury.

For convenience of reference the lacerations have been divided as nearly as possible into three degrees. The first degree is that which injures the mucous membrane, and does not affect the body of the cervix. The second degree laceration injures the body and extends upwards to the angle of the fornix. This, in turn, is divided into three degrees depending upon extent, namely, slight, moderate, and extensive. The third degree laceration extends into the broad ligament.

Of the eighty-six per cent cases showing laceration, fifteen per cent were first degree and seventy-one per cent were second degree, the great majority being moderate in extent.

An effort has been made to draw conclusions from the records that might determine to what extent certain factors might play in the character and extent of the cervical lacerations. In a study of this kind only primiparae are considered, for injuries in multiparae are apt to have their origin in previous labors. Then, too, it is difficult to draw hard and fast conclusions, for in any given case there is always a combination of factors present.

(1) *The Age of the Parturient*: The primiparae, fifty in number, varied in age from nineteen to thirty-nine years. No relation seemed to exist between their age and their injury in spite of the prevalent idea that older women receive more extensive injury.

(2) *Occipital Presentations*: In occiput anterior positions the lacerations seem to be fairly equally divided between the side on which the occiput presents and the opposite side, with possibly slightly more extensive lesions on the presenting side.

In occiput posterior positions all the cases had moderate second degree lacerations,—the side having the more extensive tear may or may not be the presenting one.

(3) *The Membranes*: In cases where the membranes remained intact until dilatation was complete, or at least well advanced, eighty-eight per cent showed second degree laceration, one-half of which were moderate in extent. There was no tear in twelve per cent. Of the cases in which the membranes either ruptured before the onset of labor or before dilatation had progressed, forty-two per cent showed

first degree laceration, and there was no tear in 28 per cent. There were second degree tears in 30 per cent, thus showing a tendency for less injury in dry labors.

(4) *Length of Labor*: Labors under ten hours resulted in no tears in 20 per cent; first degree tears in 20 per cent and second degree tears in 60 per cent.

In labors of over twelve hours there were none without tears; 30 per cent had first degree tears and 70 per cent had second degree tears, showing a tendency for more extensive injury in longer labors.

(5) *Sedatives*: Though the records are not sufficiently detailed to determine the effects of sedatives upon cervical injury there is strong indication that opiates, especially the twilight analgesia, reduce the injury by considerable degree. On the other hand, the use of pituitrin may increase the amount of injury. In this series the use of this drug before deliveries is so infrequent that the records are unreliable.

(6) *Instrumentation*: Instrumentation or manipulation of any sort doubtless increases the injury. In most cases manual dilatation means manual tearing. Forceps, as a rule, produce tears. In all the forceps cases there was none with less than a moderate second degree tear. Dilating bags usually increase the injury, especially if traction is made upon them. Version and extraction result in extensive tears. In all these cases there were lacerations, none of which was less than moderate second degree.

(7) *Size of the Baby*: The size of the baby seems definitely to influence the amount of injury. Babies whose suboccipitobregmatic circumference was 30 cm. or less, produced tears usually of not more than first degree; on the other hand, if the diameter was greater than 30 cm. there were invariably tears of second degree, either moderate or extensive.

If allowed to care for themselves most of these lacerations heal with the formation of considerable scar tissue, with erosion of the mucous membrane, with cystic degeneration of the cervical tissue, general hypertrophy and a gaping os which induces chronic infection of not only the cervical glands, but the endometrium as well. Often these conditions require surgical treatment for their cure.

To avoid these conditions the question naturally arises as to the most advantageous time for repair. Among others Emge has advocated repair immediately following delivery. His results are reported satisfactory in primiparae, but less so in multiparae with hypertrophy and disturbed cervical blood supply. The distortion and lack of tone of the cervical tissue following delivery, the interference from uterine bleeding, the difficulty of determining the extent of actual injury, the uncertainty of accurately approximating the torn edges

and the tendency for sutures to fail to hold in the edematous, almost jelly-like tissue are factors which tend to make the results of the immediate repair less perfect.

At the eighth to tenth day postpartum, however, the cervix has regained much of its tone, the exact extent of injury can be definitely ascertained, the field of operation is less hemorrhagic, and the approximation of the clean, freshened edges can be accurately obtained. Hirst recommends suture on the fifth or sixth day. Titian Coffey for the past sixteen years has made it his practice to repair the cervix routinely (except, of course, in the presence of infection) on the ninth day postpartum. Having had an opportunity of observing his results over a considerable period of time, I have been convinced that intermediate repair is the proper means of reducing much maternal morbidity, and have therefore, during the past four years routinely repaired all injured cervixes on the ninth day postpartum. The technic of the operation is as follows:

The patient is given an enema two hours before the operation and the bladder is emptied. Shaving is usually unnecessary inasmuch as it has been done at the time of delivery. An H. M. C. No. 1 tablet is given hypodermically one half hour before the operation. The patient is placed in the lithotomy position with the buttocks well over the edge. She is then cleansed with green soap and water. A lysol douche, under low pressure, is given, following which the patient is draped in the usual manner. A trivalve vaginal speculum is introduced and the cervix brought into view. A curved single-toothed tenaculum is placed into the center of the upper lip, a straight one into the lower lip in the center. These are used for traction as well as for landmarks. The trivalve speculum is then removed and a light, weighted speculum introduced and the cervix drawn forward. The cervix is then anesthetized with 2 per cent novocain in its anterior portion, but particularly behind the angles of the laceration. With cervical scissors the edges of the lacerated area are then freshened by the removal of the granulation tissue; cysts are removed, as well as small irregularities along the torn surfaces. It is seldom necessary to remove much, if any, of the true cervical tissue. To insure raw surfaces the freshened edges are finally curetted.

The laceration, on either or both sides, as the case may be, is closed by a continuous, interlocking suture of No. 2 forty-day chromic catgut, care being taken to introduce the posterior suture well behind the angle of the laceration, thereby avoiding sinus formation. Anteriorly, the suture on either side is introduced close to the tenaculæ. When the sutures are tied there is left a small os which easily admits a uterine sound. The speculum is then withdrawn and the cervix pushed well back in the vaginal vault to bring the fundus into proper position.

If perineal sutures have been introduced at the time of delivery, the cervical repair is completed before the removal of these sutures.

*Aftercare:* Following the cervical repair the patient is returned to her bed and allowed to sit up against a back-rest, to facilitate drainage. That night and each morning and night thereafter she is instructed to remain in the knee-chest position for periods of five minutes each. The day following the operation she is allowed up in a chair an hour, and each day after the time is increased. She is permitted to walk on the twelfth day postpartum and returns to her home from the hospital on the fourteenth day.



Very infrequently there is a moderate retention of the lochia for thirty-six to forty-eight hours, as is indicated by slight rise of temperature and absence of discharge. If this condition persists and is not corrected by the upright position, two or three doses of ergot will suffice to restore the normal flow.

The results of this procedure, both anatomically and subjectively, cannot be overestimated. The patients return to the office for their final examination six weeks after confinement. The cervix is then well healed, scarcely any scar is visible, the os is small and round, admitting only the tip of a uterine sound; there is absence of any eversion or erosion of the mucous membrane; the discharge if any, is a slight mucoid one which soon disappears altogether. The fundus shows marked involution and a restoration to a normal, nonpregnant state,—in fact, in many instances, it is difficult to believe that there has been any disturbance incident to parturition.

Subjectively, almost without exception, the patients show none of the symptoms or morbidity common to the parturient, such as failure to regain strength, nervousness, mental depression, backaches and feeling of heaviness and sagging in the pelvis.

Naturally, the question arises as to the effect of these repairs upon subsequent labors. In this series there are thirteen cases which had previously been repaired. The average duration of labor in these was eight and a half hours; there was one having a first degree tear of slight extent and twelve having second degree tears of moderate extent. All these were repaired following their last confinement. In fact, a cervix may be repaired repeatedly inasmuch as none of the true cervical tissue is sacrificed in the repair by the secondary operation.

In summary, we have a procedure which restores the injured cervix on the ninth day postpartum to a condition approximating that before injury. It entails no danger to the patient nor does it prolong her period of convalescence. It reduces to a minimum the morbidity often observed following confinement. It minimizes the occurrence of the familiar chronically infected cervix and endometrium. It doubtless is a definite prophylactic measure against malignancy of the uterus.

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# SO-CALLED ECLAMPSIA WITHOUT CONVULSIONS SUCCESSFULLY TREATED WITH INSULIN, WITH THE REPORT OF A CASE

BY WILLIAM THALHIMER, M.D., MILWAUKEE, WISCONSIN

THE classification of the so-called toxemias of pregnancy is generally admitted to be unsatisfactory since the causes of these conditions are still obscure. Because of this, it seems of interest to report this case, which presented a very unusual syndrome with definite abnormalities discovered with aid from the laboratory, and with successful response to the indicated treatment. The patient seemed to belong definitely to the eclamptic type but could have been classified equally well, in all probability, as either eclampsia without convulsions or pre-eclamptic nephritic toxemia. The best term for this patient's condition undoubtedly would be one which described the findings, for example: "a patient, para ii, near term, with a rapid development of coma, a high blood-sugar level, acidosis, nonprotein nitrogen retention in the blood and nephritis and death of the fetus *in utero*." This is too long, of course, and would lead us nowhere.

This report can be made more interesting if the reasons for the treatment are given at the periods during the patient's progress that the therapy was decided upon. In this way the difficulties that presented themselves can be seen.

Mrs. H., aged thirty years, has one four-year-old, healthy child. This previous pregnancy, labor and puerperium were perfectly normal. Her past and family history reveal nothing of significance.

During her second pregnancy she was under the care of Dr. R. W. Roethke, and systematic observation, including urinalysis and blood pressure determinations, showed no abnormality of any sort. Within about two weeks of term she developed small painful hemorrhoids and, probably to some extent to avoid the pain of bowel evacuations, allowed herself to become constipated. Difficulty in defecation continued for about ten days in spite of various laxatives. On October 30, 1925, there was a small exceedingly hard stool following the use of a soap stick, and she felt relieved. October 31, she still felt fetal life and examination by Dr. Roethke revealed normal fetal heart tones. November 1, a bowel movement followed an enema. She felt badly November 3 and remembers very little of what happened; from the night of November 4 she remembers nothing—she was comatose from then on. In the afternoon of November 5 she was admitted to Mount Sinai Hospital.

On admission: T. 99.8°, P. 120, R. 28, B. P. 128/85; patient in coma; evidently acutely ill. She was disoriented and unable to give any definite information at the time of examination. She answered questions poorly and then fell into a stupor. Face and skin flushed. Breath had a sweetish odor. Breathing rapid and deep. Pupils equal and reacted to light. The eye grounds showed congestion

of the blood vessels. Nose obstructed and full of discharge. Teeth normal, mouth full of debris. Tongue coated. Membranes dry and red. Respirations deep and regular. Lungs clear and resonant. Heart rate and rhythm are regular. Pregnant uterus firm and hard. Occasional contractions. Fetal heart tones not heard. The blood pressure remained normal during the entire illness. That night a proctoclysis of glucose was given but none was retained. The patient was unable to take nourishment. An enema caused a good evacuation. No urine could be obtained for examination.

November 6. The patient's condition remained the same but the urine showed a heavy reduction with 3 drops of Fehlings', and acetone and diacetic acid + + + +, albumin + + + +, with hyaline and finely granular casts. Unfortunately a blood sugar determination was not made at this time.

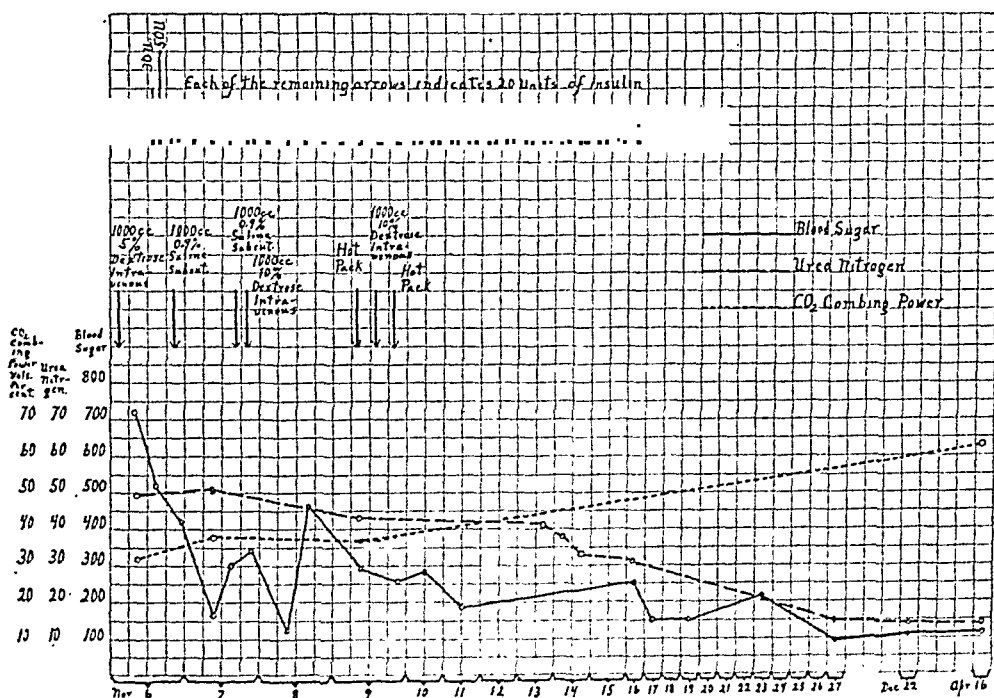


Fig. 1.

At 11 A.M. an intravenous injection of 1000 c.c. of 5 per cent glucose solution was started which ended at 12:30 P.M.; 15 units of insulin were given hypodermically. At 5 P.M. the patient was seen in consultation with Dr. Roethke. She was in an almost complete coma, pale, evidently dehydrated, eyes sunken, pulse small and rapid, abdomen distended to the size of a full-term pregnancy, but otherwise her physical examination showed no abnormality. There was no edema and the capillary circulation was good. The breath had a marked acetone odor. The nature of the patient's breathing was not noteworthy except that it was not of the Kussmaul air-hunger type.

The presence of sugar in the urine (before the intravenous glucose administration) made one consider the possibility of a sudden onset of diabetes and diabetic coma. The patient's appearance did not suggest diabetic coma; the absence of Kussmaul breathing and of glycosuria during the entire pregnancy was against it. If this was diabetes it was more sudden in its onset than the literature of diabetes, so far as I know it, has revealed. Still this had to be kept in mind. Even in the absence of edema this patient appeared to be suffering from a nephritic retention and my first impression, because of the glycosuria and the patient's

clinical appearance, was that this condition was a combination of a possible "acute" diabetes and nephritis, the latter possibly exaggerated by absorption from the dead fetus. This was given only the consideration of a clinical impression. The sequence of events: constipation, death of fetus, coma, ketosis, glycosuria and albuminuria was truly remarkable, and the explanation of the primary instigation of this chain of events was completely obscure. Intestinal stasis, ordinarily not of serious moment, even in advanced pregnancy, nevertheless seemed to have ushered in this serious and complicated condition. A blood examination performed immediately showed: blood sugar, 720 mg. per 100 c.c. (Benedict Method); blood urea nitrogen, 49.4 mg. per 100 c.c.; blood creatinine, 1.4 mg. per 100 c.c., and the  $\text{CO}_2$  combining power, 32 vol. per cent (Van Slyke Method).

This blood was drawn five hours after the glucose injection, and because of this was difficult to interpret. A personal study of normal individuals, who were given more than twice as much glucose intravenously as this patient, was far enough along for me to know that in the absence of a disorder of carbohydrate metabolism, this patient's elevated blood sugar could not be attributed to the injection of 50 grams of glucose five hours previously.\* There was a considerable retention of urea in the blood, indicating that the impression of nephritis was justified. The blood plasma  $\text{CO}_2$  combining power was low, not only lower than in normal full-term pregnancy but lower than is usually found in excessive vomiting of pregnancy with ketosis. It was not as low as one would have expected had this been diabetic coma, although its level did not rule out diabetes.

Treatment was started immediately as though the patient were in marked diabetic acidosis, deeply comatose and with complicating nephritis. It seemed that the most important element to control was the acidosis. Enemas were given also, to keep the lower bowel functioning. Induction of labor in the presence of this degree of acidosis would have been fraught with danger.

A large dose of insulin (Lilly) was given immediately, with further doses during the night. Thirty units were given at 7 P.M., 50 units at 9:30 P.M., 20 units at 12:30, 2:30, and 4:30 A.M. (140 units in 9 hours).

The blood-sugar level was followed during the night, and was 520 mg. per cent at 9:30 P.M., 420 mg. per cent at 11:30 P.M. and 160 mg. per cent at 8 o'clock the next morning (November 7). The urine sugar, acetone and diacetic acid decreased during the night and were absent at 8 A.M. The blood plasma  $\text{CO}_2$  combining power increased to only 37.6 vol. per cent from 32 vol. per cent of the night before. During the night 1000 c.c. of normal saline were given by hypodermoclysis because of the evident dehydration. Digifolin, 1 c.c., was given hypodermically every four hours.

In the morning, November 7, the patient's condition made a better impression, her pulse was fuller and less rapid, but her comatose condition was the same. The ketosis had been controlled, the blood sugar was practically normal, and the acidosis improved, but the underlying etiology was still obscure. My recommendation to Dr. Roethke was, that the patient's condition had been improved as much as seemed possible and if the time were not utilized to empty her uterus, and relieve her of the possible toxic absorption from the dead fetus, the opportunity might be lost and never return. He induced labor by a cervical pack, at 11 A.M. He was prepared to use forceps and further reduce the strain on the patient, but after an easy labor, which did not injure the patient's condition, a normal delivery of a stillborn, somewhat macerated fetus occurred in seven and one-half hours, at 6:30 P.M. (The fetus showed no other abnormality and the placenta presented no lesions).

\*The Effect of Intravenous Injection of Glucose and of Glucose and Insulin upon Blood Sugar. To be published in Jour. Am. Med. Assn.

The chart shows, in detail, the laboratory findings, insulin and other therapy, etc. Twenty unit doses of insulin were continued at intervals of four hours during the day of labor and during the night following delivery. The nurses found it difficult to force the patient to take sufficient fluids, fruit juices, and carbohydrate by mouth, so normal saline was given hypodermically and 10 per cent glucose intravenously several times during the next few days. This was done, merely to be certain that the patient received enough fluid and carbohydrates. Several hot packs were also given. The patient's general appearance gradually improved, but the coma was practically unchanged for forty-eight hours after delivery, a marked hyperglycemia continued, and also a retention of urea in the blood. The insulin dosage was reduced to 20 units every six hours and was continued for eight days postpartum. The third day after delivery the patient came out of coma rather rapidly. From this time on she took large amounts of fluids, sweetened orange juice, carbohydrate foods, etc., and the excretion of urine increased. Carbohydrate foods were not limited, but the patient was purposely urged to take them.

Some hyperglycemia persisted until the eighth day after delivery, but on the seventh and eighth days marked diaphoresis occurred at intervals, and she felt extreme hunger before meals. We thought these occurrences were indications that the carbohydrate metabolism was approaching normal and were not surprised when a moderate degree of insulin shock occurred on the ninth day postpartum. Insulin was discontinued permanently, and the patient was placed on a diet of 2500 cal. (C. 100, P. 60, F. 200).

The remainder of the convalescence was uneventful and now, five months later, the patient's recovery seems complete. On an unrestricted diet she shows a normal blood-sugar value, alkali reserve, blood urea, urine, and normal blood pressure.

#### DISCUSSION

In connection with this patient there are many data still to be desired, but those obtained seem to us to be of considerable interest and may be of value even beyond the interpretation of this case. Certainly, without the laboratory aid,\* we would have remained completely in the dark regarding the patient's condition. The course of the patient's recovery would seem to indicate that the relief of her acidosis and the control of her abnormal carbohydrate metabolism with insulin contributed essentially to her recovery. The ketosis was eliminated in twelve hours after energetic insulin therapy was started. This result can hardly be attributed to the previous small dose (50 grams) of glucose given intravenously or to the one subcutaneous injection of 1000 c.c. of normal saline. This patient's condition seems to be unique. This impression may have been received simply because other similar syndromes have not been sufficiently studied, although it is now recognized that laboratory assistance is proving to be of more and more value in studying the so-called toxemias of pregnancy.

No claim is made that this patient suffered from eclampsia. Be-

\*The efficient cooperation of Miss Wehnert, in the laboratory, and of the nurses and authorities of Mt. Sinai Hospital cannot be too gratefully acknowledged.

cause of lack of a better term, her condition was referred to as "so-called eclampsia without convulsions," which it undoubtedly would have been called if we had not had the laboratory findings. This case was of particular interest to me because of my previous interest in the treatment of postoperative acidosis and excessive vomiting of pregnancy with insulin.

This work caused me to suggest the possible usefulness of insulin in treating genuine eclampsia, and one such patient was treated with insulin, along with other methods, and recovered. The recent report of Stander of a series of eclamptics treated with insulin is very significant, and his data are very suggestive. The blood sugar of my patient was much higher than he found in his patients with true eclampsia. The possibility of convulsions alone causing a raised blood sugar must be borne in mind, but our patient had no convulsions. The cause of the temporary abnormality in carbohydrate metabolism, diabetic in type, is a complete mystery to me, and the most unusual event of all. There was no evidence of thyroid abnormality, but no basal metabolism studies were made, hence this must be kept in mind as a possible explanation.

The entire field of the so-called toxemias of pregnancy is still filled with obscurity and confusion, and for that reason is an excellent one for investigation. Statistics as to percentage of recoveries after this or that type of treatment are not as important as recognition of a response in an expected manner to a given therapeutic agent, in the direction of the physiologic action of this agent. It is this kind of response which Stander's data demonstrated to follow administration of insulin, and which makes his data and results important.

Much still remains to be learned, not only of the action of insulin, but even of the action of large intravenous doses of glucose. This study will have to be made in connection with both normal and abnormal human beings, as results with animals and with humans are not strictly comparable. Some results on normal individuals given intravenous injections of glucose, both with and without insulin, have been published elsewhere recently.\* Further studies of patients with so-called toxemias of pregnancy are progressing and will be published at some future time when sufficient data have been accumulated.

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COLUMBIA HOSPITAL.

\*Loc. cit.

## ENDOCERVICITIS\*

A CLINICAL STUDY OF 1,039 CASES, MANY TREATED WITH THE CAUTERY

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A CLINICAL study of the records and the case histories of the patients examined in the Gynecology Department of Cornell University Medical School between November 1, 1921, and March 15, 1926, has been made in order to establish the incidence of endocervicitis in the gynecologic patients. The histories, symptoms, treatment, and complications in the cases treated during the same period have been analyzed to establish the age incidence, the marital state, the cardinal symptoms, the etiologic relation to concomitant complicating conditions, the causal relation to abortion and sterility, the effect on ovarian function as evidenced by variations in menstruation, the incidence of gonorrhea and of cancer of the cervix in endocervicitis, and the comparative values of the different methods of treatment. The cases responding to the follow-up letter have been compared as to the results obtained by the various methods of treatment and as to the effect on sterility and on subsequent labors.

*Incidence.*—During the period under consideration 6,483 women were examined and the diagnosis of cervicitis or endocervicitis was made in 2,150 of them, a percentage of 33.16. The deduction cannot be made that one-third of all women have inflammatory disease of the cervix, for admittedly the patients seen in a diagnostic clinic show an incidence greatly in excess of that among women in general. The figures are of value, however, in proving that the disease is the most common that the gynecologist is called upon to treat.

*Age of Incidence.*—Many of the 2,150 women with endocervicitis were admitted to the department at the request of family physicians for diagnosis alone and only 1,039 were treated. Of this number an age analysis by decades showed the following: 28 were between ten and twenty; 405 were between twenty and thirty; 406 were between thirty and forty; 139 were between forty and fifty; 32 were between fifty and sixty; 9 were between sixty and seventy. It appears that 78 per cent of the cases were between twenty and forty years of age. The youngest patient was seventeen and the eldest sixty-nine. The average age was thirty-three and one-half years.

The age of incidence indicates that the disease is most common during the childbearing period and becomes comparatively infrequent

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\*Presented at a meeting of the New York Obstetrical Society, May 11, 1926.

after the menopause in contradistinction to cancer, in which the average age is forty-five and one-half years.<sup>1</sup>

*Single or Married State; Parity.*—Of the 1,039 cases, 959, or 92.3 per cent, were married, while 80, or 7.7 per cent, were unmarried. Also 695 women had borne from 1 to 13 children, and 382 had had from 1 to 15 abortions or miscarriages. Of those who had aborted, 73 had never borne children, leaving a total of 191 married women who had never become pregnant, or 19.9 per cent of sterile marriages. The preponderance of married women who had borne children or had miscarried, 80.1 per cent, together with the small number of single women in the series, supports the conclusion that the traumatism of labor or abortion is the chief factor in producing the disease and makes it appear highly improbable that gonorrheal infection is as frequent an etiologic factor as commonly supposed.

*Symptoms.*—The most usual symptoms complained of were leucorrhea, backache, abdominal pain, menstrual disturbance, urinary symptoms, headache, sterility, bearing down or dragging sensation, dyspareunia and a heterogenous collection of other symptoms which, except for a few cases of itching vulvae and bleeding at intercourse, did not have even a remote relation to cervical inflammation.

Of the 1,039 cases, 770, or 74.1 per cent, complained of leucorrhea; 380 women, or 36.5 per cent, had backache; 468, or 45 per cent, had menstrual disturbance; 299, or 28.7 per cent, had urinary symptoms; 316, or 30.4 per cent, had abdominal pain; 61, or 5.8 per cent, came for sterility; 67, or 6.4 per cent, had headache; 56, or 5.3 per cent, had a fallen womb, bearing down or dragging sensation; 21, or 2.0 per cent, had dyspareunia.

An analysis of the chief complaint brought out several points of interest. Most women gave two or more symptoms as of first importance. In 283, or 27.2 per cent, of cases leucorrhea was emphasized; in 219, or 21 per cent, backache; in 316, or 30.4 per cent, abdominal pain; in 61, or 5.8 per cent, sterility; in 67, or 6.4 per cent, headache; in 56, or 5.3 per cent, dragging, bearing down or fallen womb; in 44, or 4.2 per cent, urinary complaints; in 176, or 16.9 per cent, menstrual disturbance; in 204, or 19.6 per cent, the complaints were irrelevant.

It appears natural that the percentage of leucorrhea should drop while the percentages of the symptoms expressing physical suffering should rise. It is worthy of note that the patients complaining of abdominal pain or sterility always made it the chief complaint. Most of the 204 with other than gynecologic symptoms were referred from other departments of the clinic in order to establish a cause for systemic disease.

*Diagnosis.*—The clinical diagnosis of cervicitis or endocervicitis was made by direct inspection of the cervix through the vaginal speculum.



A swollen, red, ulcerated or eroded area adjacent to the external os or the presence of nabothian cysts, either with or without mucopurulent exudate and hypertrophy, was considered as establishing the diagnosis.

The presence of mucus in the cervical canal was not considered of itself indicative of endocervicitis in the absence of apparent inflammation, erosion or nabothian cysts; nor was laceration with ectropion considered indicative of inflammatory disease in the absence of erosion or cysts. Smears from the cervix were taken in 129 of the more acute cases. Only 5 of these were positive for the gonococcus, although 20 patients gave a history of probable gonorrheal infection; one of these had a positive smear, a proved incidence of 0.48 per cent, or from history 2.3 per cent. Two cases of primary syphilis with chancre of the cervix, an incidence of 0.19 per cent, were excluded by dark-field examination. No tuberculosis of the cervix was found.

*Complications.*—The most frequent gynecologic condition coincident with inflammatory disease of the cervix, exclusive of laceration or evidence of previous traumatization of the cervix itself, which was observed in every parous woman, as well as those who had aborted, was found to be uterine displacement, which existed in 460 women, 44.2 per cent; the number of patients with lacerated perineum, cystocele or rectocele, or two, or all three of these conditions, was 405, or 38 per cent of cases; patients with adnexal disease numbered 214, or 20.5 per cent of cases. As already stated, five smears from the cervix were positive for the gonococcus. The urinary tract conditions found consisted of 117 cases, or 11.2 per cent, including 49 of relaxed vesical sphincter, 4.7 per cent; 39 of cystitis and trigonitis, 3.7 per cent; 12 of urethritis, 1.15 per cent; 8 of renal ptosis, 0.76 per cent; 8 of pyelitis, 0.76 per cent; one of renal calculus, 0.09 per cent. Other complications included 47 cases of cervical polyp, 4.5 per cent of cases; 24 of fibroids, 2.3 per cent of cases; and 10 of vaginitis, or 0.96 per cent.

The occurrence of uterine displacements coincident with cervical inflammation in so large a proportion of cases, leads to the conclusion that the cervix of the displaced uterus is more prone to infection than the cervix of the normally suspended uterus; that when infection is present it is less likely of spontaneous cure, and that when apparently cured by treatment is more apt to recur.

The incidence of lacerated perineum, cystocele and rectocele, 38 per cent, leads to the same conclusion as with uterine displacement, which in most instances was also present. All these conditions probably have their effect by interfering with the normal circulation of the blood through the cervix.

The finding of 20.5 per cent of patients with adnexal disease, or 17.6 per cent with recognized salpingitis or salpingo-oophoritis, would make

it appear that endocervicitis bears a causal relation, especially so, since many cases of salpingitis and salpingo-oophoritis were observed to subside following cure of the cervix.

The absence of positive smears in all but 5 of 129 cases indicates that a small number of recent infections were seen, since the gonococcus is usually found only in the first two or three weeks of the disease. The incidence of 0.48 per cent proved by smear, or 2.3 per cent by smear plus history, can only be increased to 3.65 per cent by including as gonorrheal in origin all cases with urethritis and bartholinitis. The examination of some of the women with a history made it appear likely that the case was not of gonorrheal origin. Likewise all cases of urethritis should not be included, especially since concomitant skene duct infection was often absent.

The two bartholinian infections were probably, although not positively, due to the gonococcus. If all patients with salpingitis and salpingo-oophoritis, 183, are added to the figure representing the other complicating conditions suggestive of gonorrhea, the incidence would be increased to 21.2 per cent. Such an assumption is hardly warranted. The consensus of opinion appears to be that one-half of all cases of salpingitis is due to the gonococcus and the other half to puerperal or other infections. If one-half of 183 be added, the incidence would be 12.4 per cent. In the author's opinion, it does not exceed 5 per cent in the cases studied.

The incidence of urinary tract disease, 11.2 per cent, or of the infections, urethritis, cystitis and pyelitis, 5.6 per cent, occurring in the group, is lower than that attributed to gynecologic patients in general, which has been placed at 7.3 per cent.<sup>2</sup> Endocervicitis does not, therefore, appear to be a causative factor.

*Treatment.*—Whether a given cervix was treated with antiseptics and caustics such as iodine, silver nitrate and argyrol applied locally, or cauterized with the electric cautery, or referred to a hospital for operative treatment, was left to the judgment of the clinical assistant to whom the case was assigned. The number of patients treated with caustics and local antiseptics was 423; cautery treatment was used in 591 cases; while 25 patients were referred for operation. The local applications and cauterizations were done by ten or more different operators, many of them under the supervision of the clinic chief.

The treatment with caustics and antiseptics consisted in either an application of 7 per cent iodine to the cervical canal and external os or an application of 2 to 20 per cent silver nitrate or merely the use of 10 to 30 per cent argyrol. In some instances the silver nitrate was applied immediately after the iodine application. For the most part only very mild cases received this method of treatment.

The cautery technic consisted in lightly burning off the red area and the mucous membrane lining the cervical canal. Deep cauterization was generally avoided. Nabothian cysts were burned out. Greatly hypertrophied cervixes or elongated lips were punctured for a half inch or more with the cautery blade in some instances to produce depletion and retraction. Anesthesia was not used.

The patients were requested to douche every four hours with normal saline solution or bicarbonate of soda, 1 ounce to 4 quarts, and to return once a week for inspection and the application of antiseptics. The patients referred for operation chose their own hospitals and their own surgeons. If no selection was made, they were referred to the Woman's Hospital on the service of Dr. George Gray Ward.

An analysis of the three methods of treatment follows: Of the 423 treated with antiseptics and caustics 52, or 12.2 per cent, so treated were cured; 294, or 69.5 per cent, were improved; 77, or 18.1 per cent, were unimproved. The apparent cause of the failure to improve or become cured appeared to be insufficient treatment. Of the 591 cautery cases, 386, or 65.3 per cent, were cured; 125, or 21.1 per cent, were improved; 13, or 2.2 per cent, were unimproved; 67, or 11.3 per cent, failed to return after the cautery was used. The failure to return was found to be in most instances due to the fact that the treatment increased the leucorrhea, which created the idea that the disease had been greatly aggravated. More care to explain the after-effects of the treatment would have saved this loss of patients. Of the 25 patients operated upon 24, or 96 per cent, were cured; one, or 4 per cent, was improved but required cauterization of the cervical stump to cure the persisting inflammation. Whatever method of treatment was used the patients returned to the clinic weekly for an average of eight weeks.

*Follow-up.*—A questionnaire was sent to each of the 1,039 patients treated and a request to report for examination was made. One hundred and seventy-nine patients responded. Many of these were examined by the author. Sixty-three cases that had been treated with caustics and antiseptics reported. Of these 26, or 41.27 per cent, appeared clinically cured; 21, or 33.33 per cent, were improved; 16, or 25.39 per cent, were unimproved. The clinically cured cases were not relieved of any of the symptoms usually attributed to the disease except leucorrhea; leucorrhea persisted to some extent in 6, or 23.07 per cent; backache in 8, or 30.77 per cent; menstrual disturbance in 4, or 15.38 per cent; urinary complaints in 2, or 7.69 per cent. Those who were improved still complained of leucorrhea in 17, or 80.95 per cent, of the patients so classed; of backache in 9, or 42.95 per cent; of menstrual disturbance in 6, or 28.57 per cent; of urinary complaints in 3, or 14.28 per cent. Those who were unimproved complained of leucorrhea in 11, or 68.75 per cent, of the cases so classed; of backache

in 8, or 50 per cent; of menstrual disturbance in 6, or 37.5 per cent; of urinary symptoms in 2, or 12.5 per cent. With the 63 cases grouped together, 53.96 per cent of the patients still complained of discharge; 39.68 per cent of backache; 25.39 per cent of menstrual disturbance; 11.11 per cent of urinary symptoms.

One hundred and six patients who had been treated with the cautery reported. Of these 90, or 84.9 per cent, appeared clinically cured; 6, or 5.66 per cent, were improved; 10, or 9.43 per cent, were unimproved. Among the clinically cured patients 11, or 12.22 per cent, still complained of leucorrhea; 24, or 26.66 per cent, had backache; 19, or 21.11 per cent, had menstrual disturbance; 5, or 5.5 per cent, had urinary symptoms; 1, or 1.11 per cent, had stenosis of the cervix requiring dilatation; 30, or 33.33 per cent, had no complaint.

Those who were improved complained of both leucorrhea and backache in 6, or 100 per cent, of the cases so classed, and of menstrual disturbance in 3, or 50 per cent. None complained of urinary discomfort. Those who were unimproved complained of leucorrhea in 8, or 80 per cent, of the cases so classed; of backache in 3, or 30 per cent; of menstrual disturbance in 3, or 30 per cent; of urinary symptoms in 1, or 10 per cent. With the 106 cases grouped together, 25, or 23.59 per cent, still complained of discharge; 33, or 31.13 per cent, of backache; 25, or 23.59 per cent, of menstrual disturbance; 6, or 5.66 per cent, of urinary symptoms; 1, or .94 per cent, had stenosis.

Ten patients who had had various operations performed upon the cervix reported. These were described as tracheloplasty (1), trachelorrhaphy (1), curettement (3), amputation (3) and suspension of the uterus (2). Of these 7, or 70 per cent, appeared clinically cured; 3, or 30 per cent, were unimproved. Among the clinically cured patients there was one only, 14.28 per cent, of those so classed with symptoms persisting. This patient's chief complaint had been sterility. Suspension of the uterus and curettement had been done. The retroversion had recurred. She had become pregnant twice but had aborted each time.

Those who were unimproved reported as follows: one had amputation of the cervix performed in May, 1925, and still complained of leucorrhea and dysmenorrhea. Cervicitis was still present. The second had amputation of the cervix two years previously and still complained of leucorrhea and backache. The cervical stump was badly eroded. She had become pregnant following her operation and had miscarried. The third had curettage and cautery treatment in November, 1925. She still had leucorrhea, backache and dysmenorrhea. Inspection of the cervix showed erosion and hypertrophy present. Among the three unimproved patients leucorrhea persisted in all, or 100 per cent, of cases so classed; backache in 2, or 66.66 per cent; menstrual disturbance in 2, or 66.66 per cent.

Grouped together, 30 per cent of the ten operative cases still complained of discharge; 20 per cent of backache, and 20 per cent of dysmenorrhea.

*Pregnancy Following Treatment.*—Pregnancy occurred after treatment in 25 cases, 8 of which are recorded on clinic charts and 17 in the follow-up investigation. Of the 423 patients treated with caustics and antiseptics, 12, or 2.8 per cent, are known to have become pregnant. Seven; or 58.33 per cent, of these women were previously sterile. Two of the 12 miscarried. After cautery treatment, 10, or 1.6 per cent, of the 591 patients treated are known to have become pregnant. Of these, 2, or 20 per cent, were previously sterile. Three miscarried. Of the 25 patients operated upon, 3 are known to have become pregnant. All three, or 100 per cent, were previously sterile. Two of them aborted, one of them twice. Both had had amputation of the cervix. Of the 63 cases treated with antiseptics, who reported in the follow-up, 9, or 14.2 per cent, became pregnant; of the 106 cautery cases in the follow-up 5, or 4.7 per cent, became pregnant. Of the 10 operative cases, 3, or 30 per cent, became pregnant.

*Abortion After Treatment.*—Of the 25 patients who became pregnant after treatment, 8 have not yet reached term and 7 have aborted. Only 10 have been delivered. Two of the 12 patients who became pregnant after treatment with antiseptics aborted, 16.66 per cent; 3 of the 10 who became pregnant after cautery treatment aborted, 30 per cent; two of the three patients who were operated upon miscarried, 66.66 per cent.

*Labor Following Treatment.*—Following treatment with antiseptics 5 patients gave birth to children, 4 labors were easy and one was a forceps delivery, 20 per cent of difficult labors. After cautery treatment 4 patients gave birth to children, 2 were easy and 2 difficult, one a forceps after four hours in labor and the second a cesarean, performed on account of the pelvic measurements, a questionable 50 per cent of difficult labors. Subsequent to operative treatment one patient had a normal birth, 100 per cent of normal deliveries.

#### GENERAL DEDUCTIONS

*Endocervicitis as a Cause of Sterility.*—Of the 959 married women 191, or 19.9 per cent, had never been pregnant although but 61, or 6.3 per cent, complained of sterility. Several women were observed to become pregnant in the presence of cervicitis. In 20 of the sterile women, or 1.9 per cent of cases, no other recognized cause of sterility was observed. The others were found to have uterine displacements, adnexal disease, polypi, fibroids or vaginitis.

The analysis of 500 sterile marriages by Dr. Macomber<sup>3</sup> attributed

5 per cent to endocervicitis, a figure which appears conservative when compared with the 20 cases in 191 sterile marriages, or 10.4 per cent, shown in this study.

Of the 61 patients complaining of sterility, 13, or 21.3 per cent, were recorded as having no other evident reason for the sterility. The husbands of these patients were routinely referred to the Genito-Urinary Department and are presumably excluded from responsibility. The conclusion is reached that most women with endocervicitis may become pregnant if they so desire, since 80.1 per cent of the married women in this study had at some time borne children or aborted, but it must also be concluded that inflammatory disease of the cervix may prevent conception, since it appears responsible for 10.4 per cent of the sterile marriages and responsible for 21.3 per cent of sterility among patients desiring children.

*Endocervicitis as a Cause of Abortion.*—Of the 392 women who had aborted once to fifteen times, approximately one-half aborted spontaneously and one-half, 191, admitted induction. Only one patient with endocervicitis aborted while under observation and she had been cauterized lightly in an attempt to cure a cervicitis. Of the 1,039 women examined, two gave abortion as a reason for visiting the clinic. Neither had the Wassermann test. Both left the clinic before investigation was completed. No evidence that the disease produces abortion has been found.

*Endocervicitis as a Cause of Menstrual Disturbance through Endocrine Dysfunction.*—Menstrual disturbance was the chief complaint in 16.9 per cent of cases and was mentioned by 45 per cent of patients. The 45 per cent is made up of 296 cases, or 28.4 per cent, with varying degrees of dysmenorrhea, 100 cases, or 9.6 per cent, with menorrhagia, 72 cases, or 6.9 per cent, with metrorrhagia. These percentages are well below those usually given for the incidence of the same conditions in gynecologic patients (Dr. Mary P. Jacobi 46 per cent, Dr. Holden 47 per cent for dysmenorrhea alone). Dr. Van Duyne<sup>4</sup> in a study among college girls found 37.4 per cent of dysmenorrheas in one group, 26 per cent in a second and 13.4 per cent in a third, an average of 25.6 per cent. Sturgis observed that 35 per cent of 2,077 women employed in a department store had menstrual incapacity. The follow-up in this study showed that where dysmenorrhea existed, it was not relieved in any instance by cure of the cervix.

Many of the menorrhagias were clearly not of endocrine origin, but in the cases presumably due to ovarian hyperfunction cure of the cervical disease apparently did not lessen the flow. Likewise the metrorrhagias of the menopause presumably due to endocrine dysfunction were unaffected by clinical cure of the cervicitis. Apparently

the disease does not have an effect on ovarian function sufficient to disturb menstruation.

*Endocervicitis as a Cause of Urinary Symptoms.*—While 28.7 per cent of patients had urinary symptoms, only 11.2 per cent were found to have lesions of the urinary tract, inclusive of relaxed vesical sphincter, 4.7 per cent, and infections, 5.6 per cent. It appears, therefore, that 17.5 per cent of patients had urinary symptoms due to causes outside the urinary tract. Complicating conditions were found to be responsible for these symptoms except in 45 patients, or 4.3 per cent of cases. In the follow-up, the patients with urinary symptoms persisting had definite lesions to account for them. Furthermore, the incidence fell to 5.6 per cent in the cured cases. This may mean that endocervicitis can in some instances produce urinary symptoms, but, as stated in discussing complications, clinically it does not appear causative of urinary tract infections.

*Endocervicitis as a Cause of Leucorrhea.*—Leucorrhea has been said to be due to disease of the cervix in 95 per cent of instances. In this study 74.1 per cent of patients gave it as a complaint. In all the 1,039 patients examined, its presence was noted by the examining physician, although some of the women with the most profuse discharge appeared oblivious to it. Its apparent cessation, as well as the absence of inflammation, was the standard by which clinical cure was judged. The number of patients clinically cured by all methods of treatment was 462. In the follow-up 123 of the 179 cases reporting, or 68.7 per cent, were cured of all evidence of cervical disease, although 17, or 13.8 per cent, of the cured cases still complained of discharge. The cessation of leucorrhea in 86.2 per cent of the cured cases establishes the symptom as due to endocervicitis in at least that percentage of instances.

*Endocervicitis as a Cause of Backache.*—Backache has usually been considered a symptom of endocervicitis. In this study 381 women, or 36.5 per cent, complained of backache. A study of the complications existing showed that backache did not exist unless the disease was complicated by some other recognized cause of that symptom, except in 4 cases. The clinically cured patients reporting in the follow-up all had backache when backache was an original complaint. Of those cured by antiseptics backache persisted in 30.77 per cent; of those cured by cautery, in 26.66 per cent; of those cured by operation, in 30 per cent. If unexplained backaches were all attributed to this disease the incidence would be 0.38 per cent. Backache, therefore, is not a symptom of inflammation of the cervix.

*Endocervicitis as a Cause of Abdominal Pain.*—Abdominal pain was complained of by 316 women, or 30.4 per cent, all of whom, except 20, were found to have a definite cause other than cervicitis, such as,

salpingitis, adnexal disease, uterine displacement, fibroids, cervical polyp and urinary tract disease. The 20 patients in whom no cause of pain was recorded were apparently not sufficiently observed. The follow-up failed to show that uncomplicated endocervicitis is ever a cause of abdominal pain.

*Endocervicitis as a Cause of Cancer of the Cervix.*—The precancerous nature of endocervicitis has recently been emphasized by pathologists. In this series of 1,039 cases, cancer occurred only once, an incidence of 0.09 per cent.

Mrs. A. was admitted to the clinic on July 21, 1922. Aged thirty-seven years. Married 10 years. No children. Three miscarriages, last 6 years before. No trouble. Menstruation  $17 \times 28 \times 3$ , last time July 16, 1922. No operations. No sicknesses. Complaints: pain on right side and in vagina; dyspareunia on and off for about 2 years, worse in last month. Slight discharge. Bowels regular. Gets up once at night to micturate, slight burning at times. The uterus was movable, anteflexed, normal size. The diagnosis was cervicitis.

The history was taken and the first examination made by an experienced gynecologist and pathologist. She was treated by him and other members of the staff with antiseptics and caustics continuously for 22 months until May 1, 1924, when the cautery was used. Considerable bleeding followed and healing did not take place, so that two and a half months later the cervix was recauterized. No improvement followed and the patient was referred to the hospital December 30, 1924. The examination showed erosion of posterior cervical lip, destruction of cervical tissue up to vaginal junction, moderate erosion anteriorly and laterally about external os with extension of carcinomatous tissue up into cervical canal, involving by infiltration the entire cervix and beginning parametrial involvement. Dilatation and curettage were done, followed by the insertion of 100 mg. of radium for 24 hours.

The pathologic diagnosis was squamous cell carcinoma with a small amount of normal endometrium.

The complaint of pain in the vagina and increasing dyspareunia for 2 years, as well as the failure of the supposed cervicitis to improve under continuous treatment for 22 months and the advanced involvement found at operation, is evidence that the disease was carcinoma from the beginning and that no change from cervicitis to malignancy occurred. A 4-plus Wassermann was early obtained and antisymphilitic treatment given. The syphilis was thought to explain the failure to heal and delayed the recognition of the true condition. No positive evidence of the so-called precancerous nature of endocervicitis can be observed *clinically*.

#### SUMMARY AND CONCLUSIONS

Cervicitis was present in 33.16 per cent, or about one-third, of gynecologic patients, an incidence lower than that usually attributed to the disease but higher than should be found among women in general.

The age incidence of 33.5 years confirms the conclusion that the disease is usually found during the childbearing period.

The traumatism of labor or abortion appears to be the chief etiologic factor, since 80.1 per cent of the patients had borne children or had aborted. The married state in itself appears to be a factor; of the



92.3 per cent of patients who were married there were 12.2 per cent who had never been pregnant, as compared to 7.7 per cent of single women.

Uncomplicated endocervicitis has no cardinal symptom except leucorrhea, of which 74.1 per cent of the women complained. The cessation of discharge in 86.2 per cent of cured cases establishes the symptom as due to endocervicitis in that percentage of instances.

The incidence of abdominal pain, 30.4 per cent, as the chief complaint exceeded that of leucorrhea, 21 per cent, but was explained by complicating conditions, most often salpingitis, and is not a symptom of cervical disease.

Uterine displacement, occurring in 44.2 per cent of cases, or perineal lacerations with cystocele and rectocele, occurring in 38 per cent of cases, or the combined conditions are complications which favor the development, continuance and recurrence of the disease.

A primary endocervicitis is in many instances causative of salpingitis and salpingo-oophoritis, although the reverse may be true, as shown by failures to cure. The gonococcus is seldom the organism infecting the cervix, judged from the proved incidence in this series of 0.48 per cent, the possible incidence of 3.65 per cent.

A small number, 12.2 per cent, of cases of inflammation of the cervix may be cured by the application of antiseptics and caustics. These were apparently the least diseased cervixes, consequently it must be judged that treatment of this kind is apt to be palliative, not curative, and seldom indicated.

The use of the cautery should be accepted as the standardized method of treatment, since 65.3 per cent of patients so treated were cured and no dystocia in subsequent labors resulted.

The cervix should seldom be operated upon in the presence of inflammatory disease. The percentage of cures is high, 96 per cent; 70 per cent in the follow-up. The tendency to become pregnant is increased; 30 per cent in the follow-up. The liability to abort is increased, 66.66 per cent, especially by amputation. Dystocia from tracheloplasties is reported in the literature,<sup>5</sup> but none in this study have gone through labor.

Endocervicitis is a frequent cause of sterility, accounting for 10.4 per cent of sterile marriages in this study or 21.3 per cent of sterility among the patients desiring children. It is not a cause of abortion, but abortion may cause it.

It does not cause endocrine, especially ovarian, dysfunction, since it apparently does not produce menstrual disturbance.

It is not a cause of backache, abdominal pain, or urinary tract disease.

Clinically no evidence was found that endocervicitis is a precancerous lesion.

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(For discussion, see page 422.)

## SEMEN INJECTIONS WITH SEROLOGIC STUDIES

## A PRELIMINARY REPORT

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SEVERAL clinicians and immunologists have expressed the possibility of creating an active immunization to spermatozoa by injecting them in a manner analogous to the injection of vaccines. The experiments noted below were performed to determine, first, whether a spermatotoxic principle could be produced in the sera of women injected with seminal fluid containing spermatozoa, and secondly, to find out whether a biologic body capable of binding complement is elaborated.

Guyer demonstrated a spermatotoxic action in the sera of fowls injected with rabbit sperm. He also demonstrated a spermatotoxin in the sera of injected female rabbits; this spermatotoxin, however, was not as potent as the spermatotoxic substance he was able to produce in the sera of male rabbits. His method, and indeed the method of most observers employed to demonstrate the presence of spermatotoxin, consists in mixing the serum of the "immunized" animal with the sperms of the animal from which the material for injection was obtained. Drops of this mixture are studied under the microscope at regular intervals, paying particular attention to the morphology, the degree of motility and the length of life of the spermatozoa in the serum. A control of either undiluted semen or semen diluted in normal saline or weak bicarbonate solution is examined at the same time. Death of the spermatozoa or a very marked diminution in their motility within a few minutes after their contact with the serum is considered a positive reaction.

My experience in human beings consists of the following three hospital patients:

CASE 1.—Mrs. J. B., aged fifty-one, was suffering from encephalitis lethargica. At the time this patient was studied, foreign protein was being extensively used in the treatment of encephalitis, and her attending physician kindly permitted me to

make the semen injections. I employed human semen containing very large numbers of well-formed actively motile spermatozoa. The semen was sterilized in a water-bath at 60° C. for one hour. The first injection consisted of 0.5 c.c. of semen and was injected into the subcutaneous tissues of the arm. Four additional injections of 1 c.c. each were injected subcutaneously at three day intervals. There was neither a local nor general reaction following these injections. There was no evidence of any spermatoxic action in the serum.

CASE 2.—Mrs. I. E., aged thirty-five years, was suffering from rheumatic valvular cardiac disease. She was injected as was the first patient except that for one injection fresh semen with living spermatozoa was used in an effort to provoke a spermatoxic reaction. Following this injection there was a moderate local reaction in the arm and a slight rise in temperature. No spermatoxic action was demonstrable in the serum.

CASE 3.—Mrs. A. K., age twenty-nine years. This patient was suffering from multiple arthritis. The Wassermann reaction as well as the complement-fixation test for gonorrhea was negative. This woman received eleven injections of semen. After four injections, one of fresh semen containing living spermatozoa and the other three consisting of semen preserved with a little neutral acriflavine solution, her serum was examined. The motility of the spermatozoa in the serum after four hours was good, after eight hours it was greatly diminished, after twenty-four hours only two spermatozoa were seen feebly moving, and after twenty-eight hours no living spermatozoa could be found. The patient imagined that her joint pains were relieved by these injections and requested that she be given more. I injected her with 1.5 c.c. of semen containing living spermatozoa in an effort to obtain a real positive reaction, i. e., complete or almost complete absence of motility in from five minutes to a half hour. Three days later I injected her with an equal quantity of semen preserved with acriflavine solution. The day after this injection I again examined the serum and found that after twenty-six hours all the spermatozoa in the control had died while the spermatozoa in the serum were very active. I then injected her with an ether extract of semen and she developed a marked local reaction, incidentally the only reaction she ever developed. On account of this reaction I did not repeat the ether extract injections. I then injected her with 1 c.c. of fresh semen and the day after with the same quantity of the same semen preserved with acriflavine solution. Three days later she was again injected with live spermatozoa and on the following two days with semen plus acriflavine solution. Ten days after this last injection a complement-fixation test was carried out, using human semen as an antigen. The antigen was titrated in the usual manner. The reaction was negative. Ten days after this complement-fixation test, I again examined the serum as described above and found no spermatoxic reaction. I purposely waited before examining the serum in the hope that a spermatoxic substance would be formed in the interim. The patient then left the hospital and it was impossible to continue the injections.

In the following experiments two female rabbits were employed with one male rabbit used as a control. Over a period of two months the two female rabbits were injected subcutaneously every third day with 1 c.c. of human semen, except for the last injection, which was given intraperitoneally. The serum test for spermatoxin was uniformly negative. Forty days after the last injection a complement-fixation test was performed using as antigen semen diluted in normal saline. This antigen was titrated in the usual manner. The test was strongly positive in the sera of both female rabbits in dilution of 1:200 and 1:400 and weakly positive in a dilution of 1:600. The serum of the uninjected male rabbit was negative as was also a control human serum. This test was repeated eleven days later and the results obtained

were similar to those of the first test. The test was repeated for the third time eight days after the second test and the results were weakly positive, i. e., 1 plus. It was determined before proceeding with the complement-fixation test that the "immunized" rabbit alone did not bind complement, that human serum alone did not bind complement, that semen alone did not bind complement, and that rabbit serum mixed with an equal quantity of human serum did not bind complement.

#### SUMMARY

Three women received repeated injections of human semen containing spermatozoa. Only two reactions, both local and neither serious, were encountered. The semen injected was prepared in several ways: (a) obtained under aseptic precautions and injected in the fresh state; (b) in a water-bath at 60° C. for one hour; (c) preserved with a weak solution of acriflavine. Acriflavine was used because its antiseptic action, it is claimed, does not produce a coagulation of proteins.

A definite positive test for a spermatotoxic body was not demonstrable.

In the serum of the female patient subjected to a complement-fixation test the result was negative.

In the sera of the two injected female rabbits a spermatotoxic principle was not demonstrable. There was, however, clearly demonstrated a complement-binding body. The quantity of this substance was rather rapidly diminished.

#### COMMENT

Careful observers have demonstrated that fertility in the male animal can easily be diminished or destroyed by injection of spermatozoa. These injections cause atrophy and sometimes necrosis of the testes. It is much more difficult to produce corresponding phenomena in female animals. In human females I was unable to demonstrate any antibodies after injections of both live and dead spermatozoa. Isolated, vague reports from birth control clinics seem to show that women who have been injected with semen can avert pregnancy for about twenty months. This temporary sterility is probably due to the production of a spermatotoxic antibody. This antibody apparently disappears or is greatly diminished in quantity at the end of twenty months. (Should the opportunity present itself I hope to study this problem.) It may be possible to regulate the injections so that a sufficient quantity of spermatotoxic substance would always be present in the serum. Such a procedure would indeed lighten the load of the women in whom pregnancy is contraindicated. Judging from the women studied in our series, it would require many semen injections to initiate the production of spermatotoxin.

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1272 GRAND CONCOURSE.

## NOTE ON A METHOD FOR ANTEVERTING RETROVERTED UTERI

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WITH the usual bimanual method of replacement we frequently experience great difficulty and even failure in bringing a retroflexed or retroverted uterus forward if the malposition happens to be marked, or if mobility is limited. As a result of my endeavors to

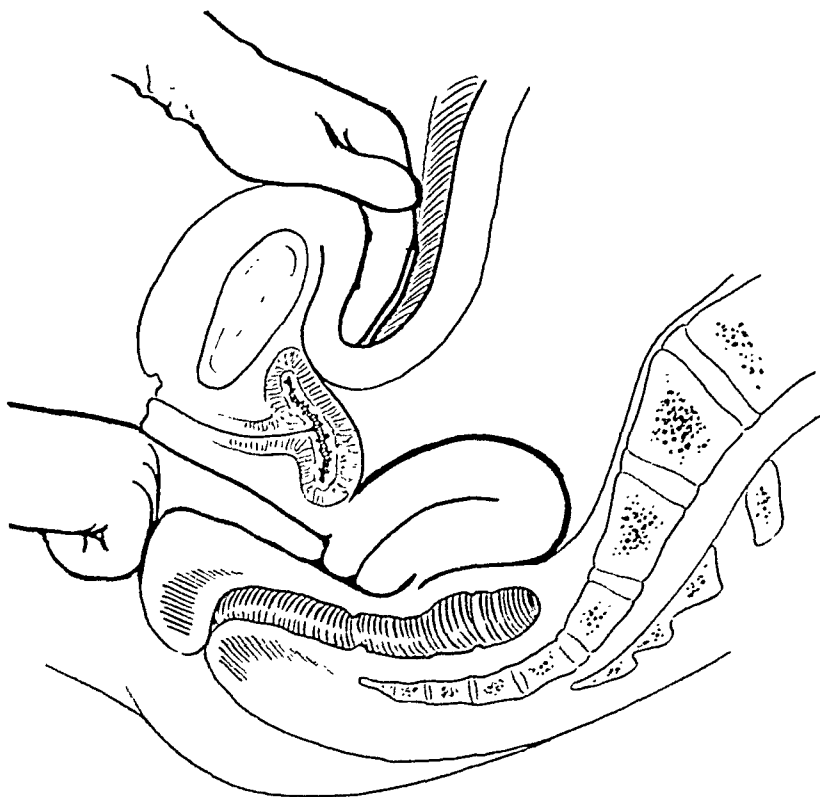


FIG. 1.

overcome this difficulty I have developed a technic which will, in the majority of cases, in the absence of adhesions, temporarily overcome this condition so as to facilitate the introduction of a pessary, packing or tampon; and in those cases which are apt to yield to nonsurgical treatment as an auxiliary therapeutic measure.

Prerequisites: (a) absence of acute inflammatory conditions; (b) dorsal position with knees flexed; (c) relaxed condition of abdomen.

With firm pressure of one or two fingers on the anterior surface of the cervix, in a direction backward and upward and with all the fingers of the other hand starting from a point just above the symphysis, pressure is exerted in a direction backward as far as possible and somewhat downward (Fig. 1). With both hands in the position described, the external hand is suddenly released (Fig. 2). This causes the body of the uterus to spring forward and the cervix backward. The internal fingers are now, as well as later, accommodated to the changed position of the cervix, so as to maintain a vantage position for pressure, and the depression and release of the external hand is repeated until the uterus is progressively brought in an anterior position (Fig. 2), or until it is sufficiently forward to facilitate the completion of the anteversion in the usual bimanual way.

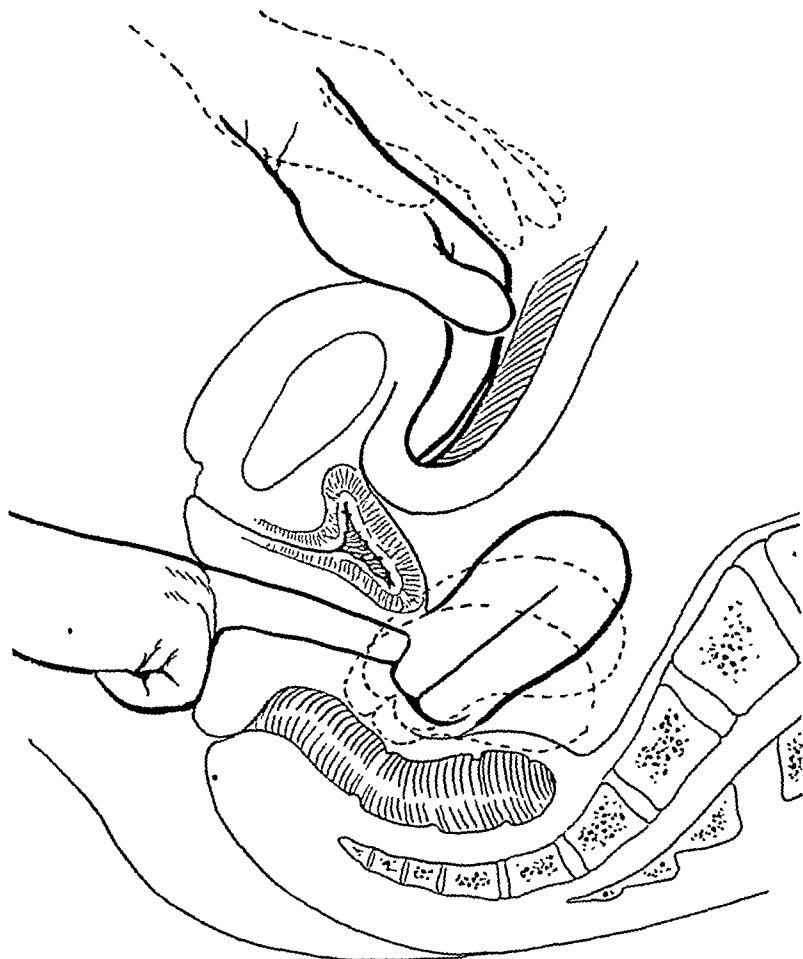


Fig. 2.

The anteversion of the uterus is favorably influenced when the technic is preceded by a few bilateral or combined bilateral and anteroposterior movements of the cervix at a high level, or of the body of the uterus, if possible.

In cases of dextroversion or sinistroversion (and even when the uterus is in a median position), it is frequently advantageous to place the external hand to the right or left of the median line on the same level with the symphysis, or to alternate the positions, with the object not only of initiating the dislodgment of the uterus but of accomplishing its anteversion as well.

When employing this technic as an auxiliary therapeutic measure I bring the uterus to an exaggerated anteversion and maintain it in that position, bimanually, for two or three minutes before instituting treatment.

# A STUDY OF THE CONTOUR ABDOMINAL MEASUREMENT OF PREGNANCY

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THE purpose of this paper is to study the contour abdominal measurements of pregnant women in regard to estimating the probable date of labor. I will recapitulate the ideas of the past and eliminate some of their undesirable factors, paying particular attention to the various positions and some abnormalities of pregnancy. To determine the value and possibilities and attempt to decide what method would be best to follow is the ultimate aim.

Ahlfeld, of Leipzig, was the original nineteenth century investigator and first used the tape and pelvimeter. Baume, his associate, studied a frozen longitudinal section of a dead pregnant woman and reported interesting details of fetal length in utero and thickness of maternal abdominal walls in regard to this measurement. Suttigen, of St. Petersburg, confirmed Ahlfeld's observations and conclusions. Through following years Reid, Tramer, Walraf, Tessier, Shatz, Issmer, Spiegelberg, Winckel, Hecker and Buhl, Schroeder, Krönig and Zweifel, Kleinwächter, Pfaunkuch, Karb, Morris, Voorhees, Stone, Ostreil, Blau and Christofolletti, and Reed reported various details concerning the duration of pregnancy and influences causing variations in the length and weight of babies, and the value of the introduction of premature labor. Pawlik, Müller, Schatz, Perret, Munroe-Kerr, Pinard and Stone observed especially details of the fetal head in regard to the maternal pelvis. Most men of the past were particularly desirous of more data concerning a definite relationship between fetal biparietal diameter and the maternal pelvis. McDonald (1906) first placed special emphasis upon the value of tape measurements in forecasting the probable date of labor which Ahlfeld and Suttigen formerly condemned. Reed (1920) popularized this method by advocating the introduction of labor to prevent postmature babies, using the measurements as a guide. Spaulding\* (1913) presented the first and only real statistical study of value from which he evolved a working rule more complicated than that of McDonald.

McDonald measures with a tape "from the upper edge of the symphysis over the abdominal contour to the highest point of the fundus save at the last dip where the tape continues to the ensiform (multipara with relaxed abdominal walls should be supported on the sides to make the occipital coccygeal axis of the fetus in the long axis of the body)." Spaulding measures "from the upper edge of the symphysis over the abdomen with the distal tape finally resting on the ensiform cartilage, being watchful that the uterus is at rest, of careful measuring, skill in estimating the degree of settling and thickness of abdominal walls and elimination of multiparity and hydramnios conditions." In both methods the height of the fundus above the symphysis is recorded from the tape.

From the past investigations let us record certain fundamental facts. Until 1905 all investigations condemned the method as very unreliable and inaccurate. The fetus has a natural position in utero, i.e., bending its head and crossing the arms over its breast with the bended knees brought forward up toward the abdomen and the spine

# *ORPLate Less Than 2Wks*

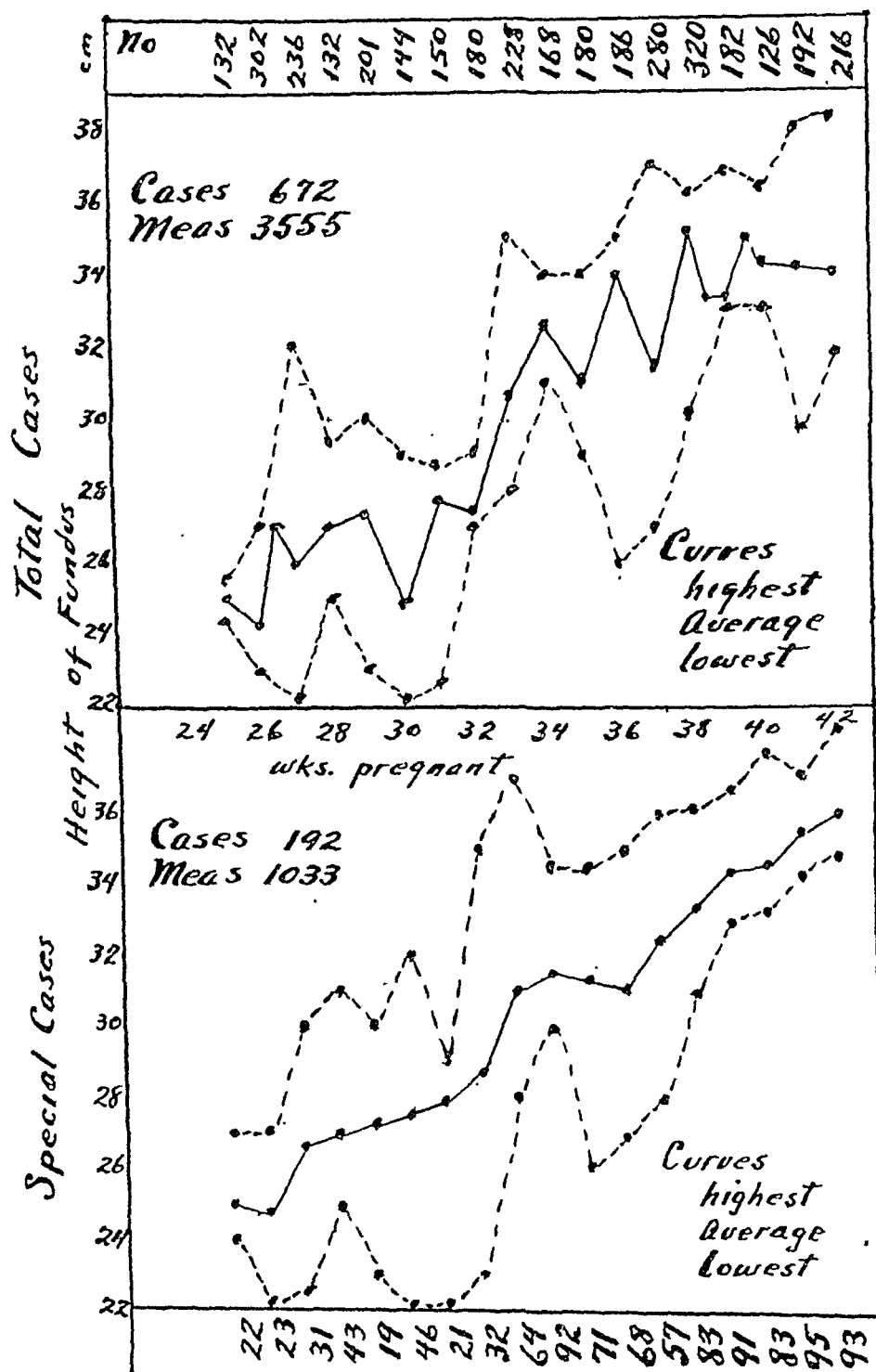


Chart I.—O.R.P. Late. Highest and lowest curves fluctuate less widely in late pregnancy but still are very far apart and their mean difference is the same in both classes. Average curve improves in special cases where it remains closer to the low curve. Therefore, in Chart I, measurements in early pregnancy are very unreliable with possibility of great error until the thirty-eighth week, regardless of the careful expurgations as in special cases. My observations have been that this position is very unreliable the reason for which I have attributed to flexion of fetal head and spine. Certainly no great operative procedure is justified because of an enlarged O.R.P., late McDonald.



flexed so that it represents an egg-shaped outline. Its position determines the shape of the uterus rather than the uterus causing fetal position. The length of the fetus is the surest indication of its age in gestation and equals twice the interuterine axis. Growth of the uterus increases gradually between the twenty-fourth and fortieth week of pregnancy. This fact is denied vigorously by Spaulding who declares that the rate of growth decreases as the weeks of pregnancy increase. Height of the fundus depends on the fetal occipital coccygeal diameter and at term approximates 35 cm. This height varies with the contraction of uterine muscle and oblique measurements. When at rest on the back the uterus rarely descends in ten lunar months of pregnancy. The convexity of the fundus is not constant. Abdominal measurements vary with certain influences, such as thick abdominal walls, full bladders, contracted pelves, lightening, hydramnios and multiple pregnancy. McDonald formulated the rule: "Divide height of fundus in centimeters by  $3\frac{1}{2}$  to obtain the lunar month of pregnancy" which he claims is very accurate after six months gestation and more accurate under 35 cm. than above it, but Spaulding maintains it is close to Nagel's rule only during the last four to six weeks. Spaulding presented a more complicated rule as follows: To obtain the week of pregnancy

When 22 to 26 cm., add 2 to height of fundus in centimeters

When 26 to 30 cm., add 3 to height of fundus in centimeters

When 30 to 32 cm., add 4 to height of fundus in centimeters

When from 32 cm. on, add 5 to height of fundus in centimeters

He concludes that "abdominal measurements are of value in estimating the degree of maturity of the unborn child and the probable week of pregnancy can be determined by careful measurements, being especially good for those who go overtime." The impetus for this present investigation lies in the fact that few men have publicly declared the value of this measurement and only one of these offers statistical observations; yet these few men differ upon one important fact, i.e., the rate of growth of the uterus during the latter part of pregnancy, a fact which is vital in estimating the probable date of labor.

The value of this measurement centers upon its dependability. If reasonably accurate it would be another check to aid in forecasting the probable date of labor since conception occurs in the pre- and post-menstrual cycle and Nagel's rule (counting back three months and adding seven days) naturally varies accordingly. The following statistics have proved that Nagel's rule in 5198 cases was correct within two weeks in 87 per cent, in one week 81 per cent, and absolutely correct in 19 per cent. The height of the navel above the symphysis varied from 12 to 20 cm. in 2000 cases and from 12 to 23

cm. in my 1200 cases. The ensiform notch varies in proportion from the symphysis and depends too upon the flexion of the maternal vertebral column. Quickening varies somewhat with the degree of

# O.L.P. Late Less Than 2 Wks

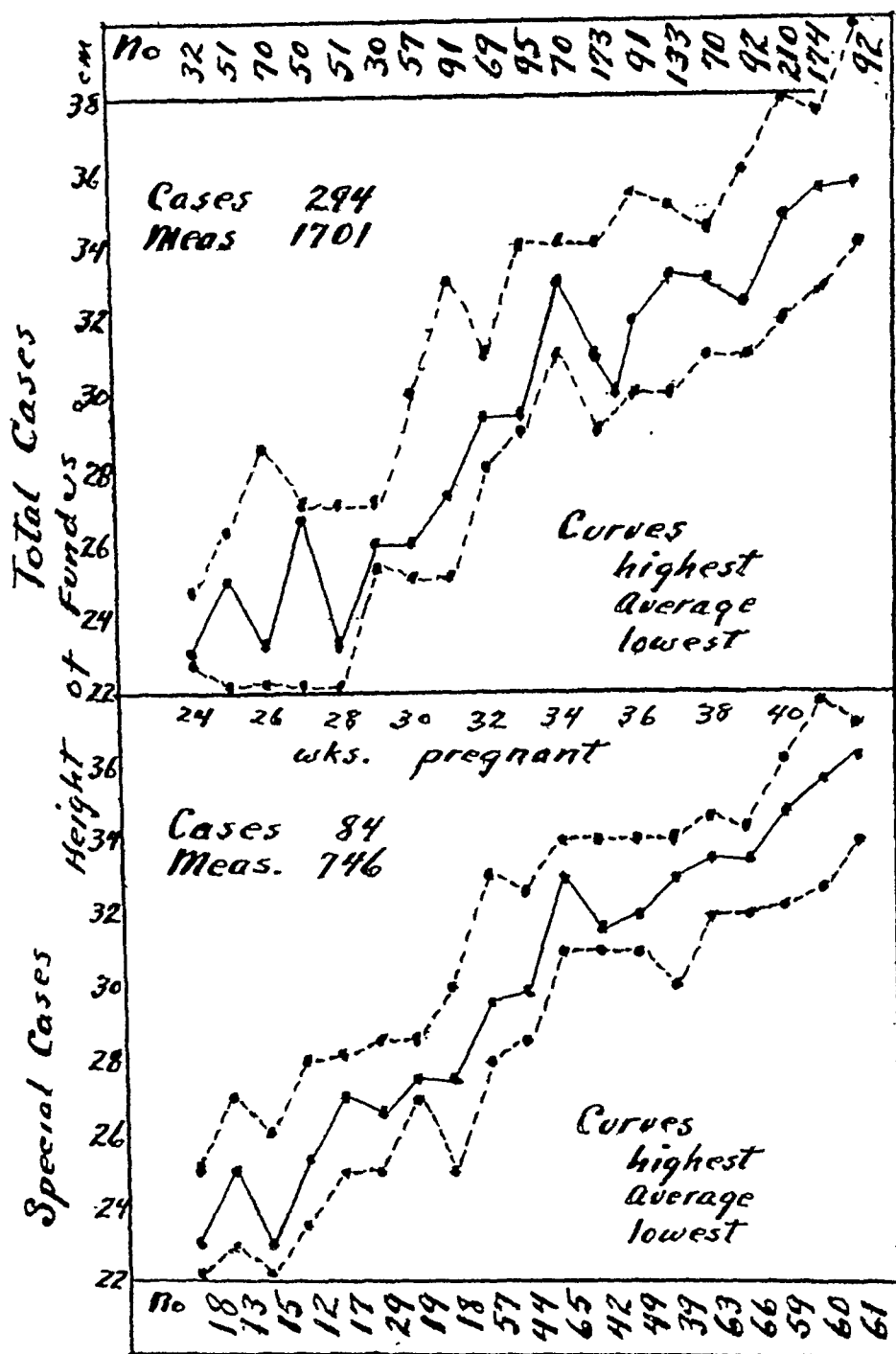


Chart II.—In O.L.P. Late. The special high and low curves have less fluctuation and remain closer to the average line, and their difference improves as pregnancy advances. The average curve fluctuates out of unison with high and low curves, meaning irregularities in measurements are common even in special cases. Before the thirty-sixth week under measurements predominate, after which over ones are more numerous. This chart might be classified as reasonably accurate.

sensitiveness of the individual nervous organism. At present in fact we have no real accurate method of determining the probable date of labor. Such a method would be a balm to the nervous and especially the greatly concerned, unexperienced, first-time pregnant woman and satisfy the frequent queries, "Am I too large?" "Am I all right?" We could truthfully advise the stranger whether she dared travel to her own home. Forgotten dates of last menstruation and quickening would not leave us so stranded as we are today and the confidence of our patients as well as better psychologic control would result. We could foretell and prevent oversized babies as well as those not infrequent postmature pregnancies with their accompanying hard labors and often permanent maternal morbidity and possibly fetal mortality. Borderline cesarean and version cases could often be treated by bag induction since the biparietal diameter of the fetus could be indirectly calculated from the estimated fetal length and checked against the Perret measurement. Legally the age of the fetus in utero might become of value. Abnormalities could be suspected and the obstetrician forewarned against misplaced positions, multiparity, extended head, or ovarian, uterine, and pelvic tumors. Lastly, for those who recognize the religious power of Rome and require rigid assurance of fetal viability, such a measurement if dependable would be of great value in the protection of baby mortality in early gestation where mothers are perhaps in the extremes of toxemia, nephritis, cardiac decompensation, typhoid, diabetes or chorea, etc.

In reviewing former observations certain weak spots become evident. The biologic factor of error has been increased through the use of measurements by a variety of different men in different clinics. McDonald lacks well recorded statistics. Spaulding lacks individual observations thereby increasing his factor of error. No study of the various common fetal positions has been presented nor has a method of estimating the result of fetal engagement been devised. Very few abnormalities have been emphasized and little attention paid to uterine contractions and their influence. In general, presented observations are comparatively small in number, Spaulding using 100 to 400, Ahlfeld 250, Suttigen 409, while McDonald lacks statistics. The present rules vary with the different weeks in pregnancy and are not very accurate. The lack of one large mass of material measured and observed by one individual, the small attention to various common normal positions and meager statistics are the outstanding defects in the present literature.

With the foregoing details in mind the following presentation has been studied with special stress upon the defects to date. From 1917 to 1924 I have collected a large mass of material in and around the regions of Kansas City which is presented in Table I, and totals 5500 cases with 22,500 measurements. One thousand three hundred two

O.L.A. Late Less Than 2 Wks

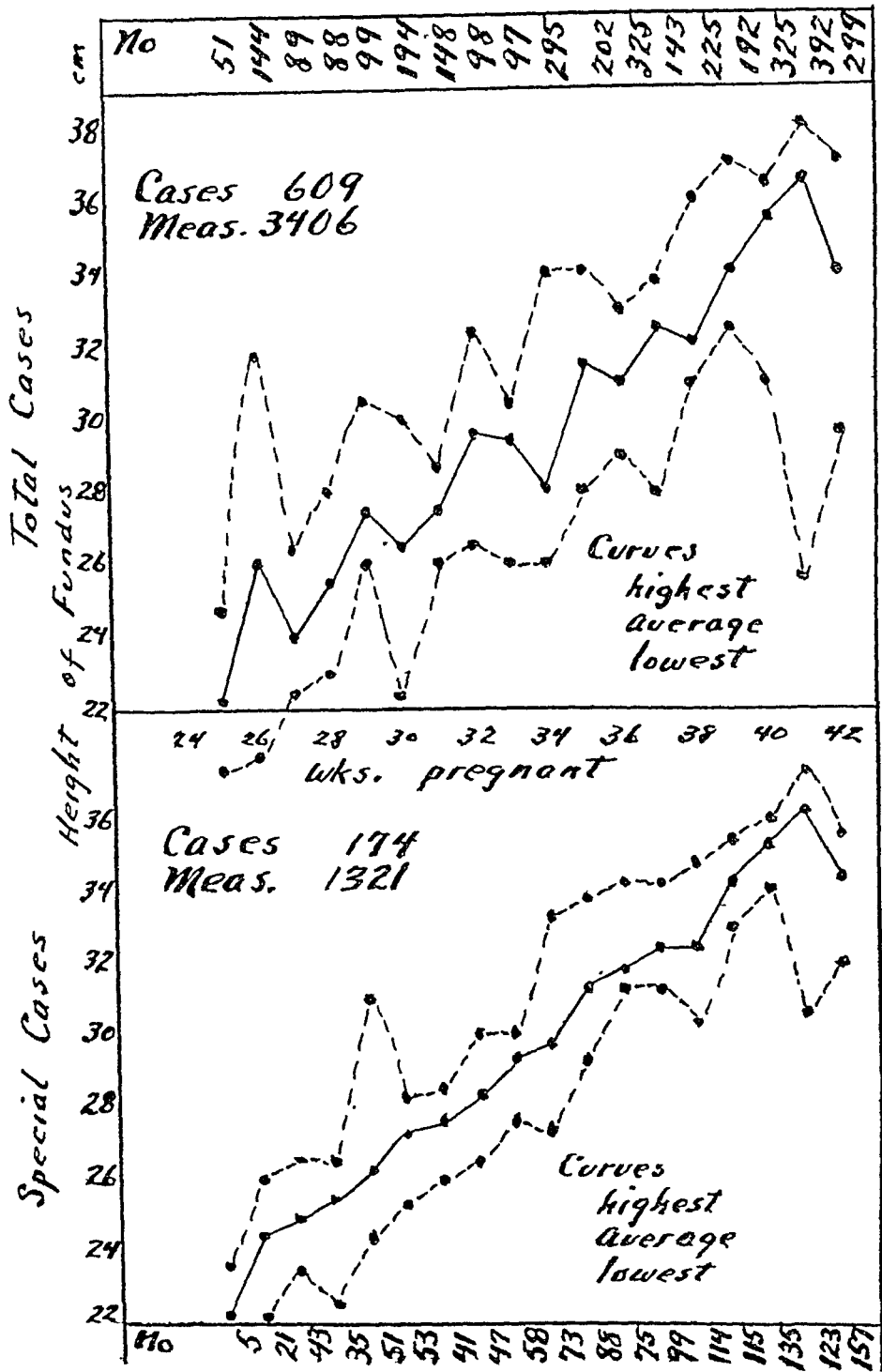


Chart III.—O.L.A. Late. Special cases show even high and low curves, closer together, steady throughout twenty-fourth to fortieth week, fluctuating in common with the average which is close to the center line. This chart is more reliable, less liable to erratic results and increases in value in special cases. The drop in the forty-first week not due to lightening probably results from increased Braxton Hicks contractions during that week which I have noticed often seem unusually strong.

cases totalling 2,832 measurements have been expurgated as representing gross mistakes through abnormalities or cases not paralleling Nagel's rule close enough for study. The remaining 4,198 cases with their 19,666 measurements all came within two weeks of the expected time according to Nagel's rule. Not included in this material are 1,209 cases with 7,268 measurements comprising private work and cases kindly loaned to me for study. These measurements were all made and their menstrual dates personally verified by me. It is my intention to compare these two classes of material thereby checking the work of the past on a larger scale than heretofore, as well as presenting a number of personally observed cases with a constant biologic factor of error in measuring reduced to one. Hereafter the two classes of material will be designated as "total cases" and "special cases." All material has been classified into the routine vertex positions, breech, twins, and cesarean. Where the material was sufficient, cases coming within two weeks of Nagel's rule were classified as early or late signifying whether they occurred before or after the standard predicted time of labor. In all cases certain factors of error have been eliminated where possible, the special cases being much more refined than the general material. Measurements vary with the individual performing them and his knowledge of the exact rules laid down by McDonald and Spaulding whose methods result practically the same. Too many read the tape first and fit it to the contour of the abdomen. One or 2 cm. error in reading have not been uncommon in my experience with other men. Measurements becoming smaller after a cathartic have been refused. Pendulous abdomen or much abdominal fat have so seriously upset calculations as to be laughable. Measurements smaller than those in the preceding two weeks have been eliminated as well as each following it.

Tumors of the ovary or uterus, much tympanites, hematoma of the broad ligament, full bladder, full rectum and ascites have in my experience completely upset scientific control. No contracted pelvis is included. All uterine suspensions which have been observed to produce shorter babies were not considered. No contracted uterus which occasionally varied 2 to 5 cm. or a uterus at rest during labor which has varied 2 to 8 cm. was retained. Hydramnios which McDonald insists caused no trouble, in my hands has changed science to the ridiculous. Poor presentations gave wretched measurements. Floating heads were pushed to the pubes or refused. Lightening which was very unusual was always carefully eliminated, often checked by rectal examination and attempts at skill in estimating this degree of settling were referred to a chart of its own. Where possible, extension of fetal head or fetal spine was eliminated but no doubt severe errors of this nature may be included due to the impossibility of the

O.R.A. Late Less Than 2 Wks.

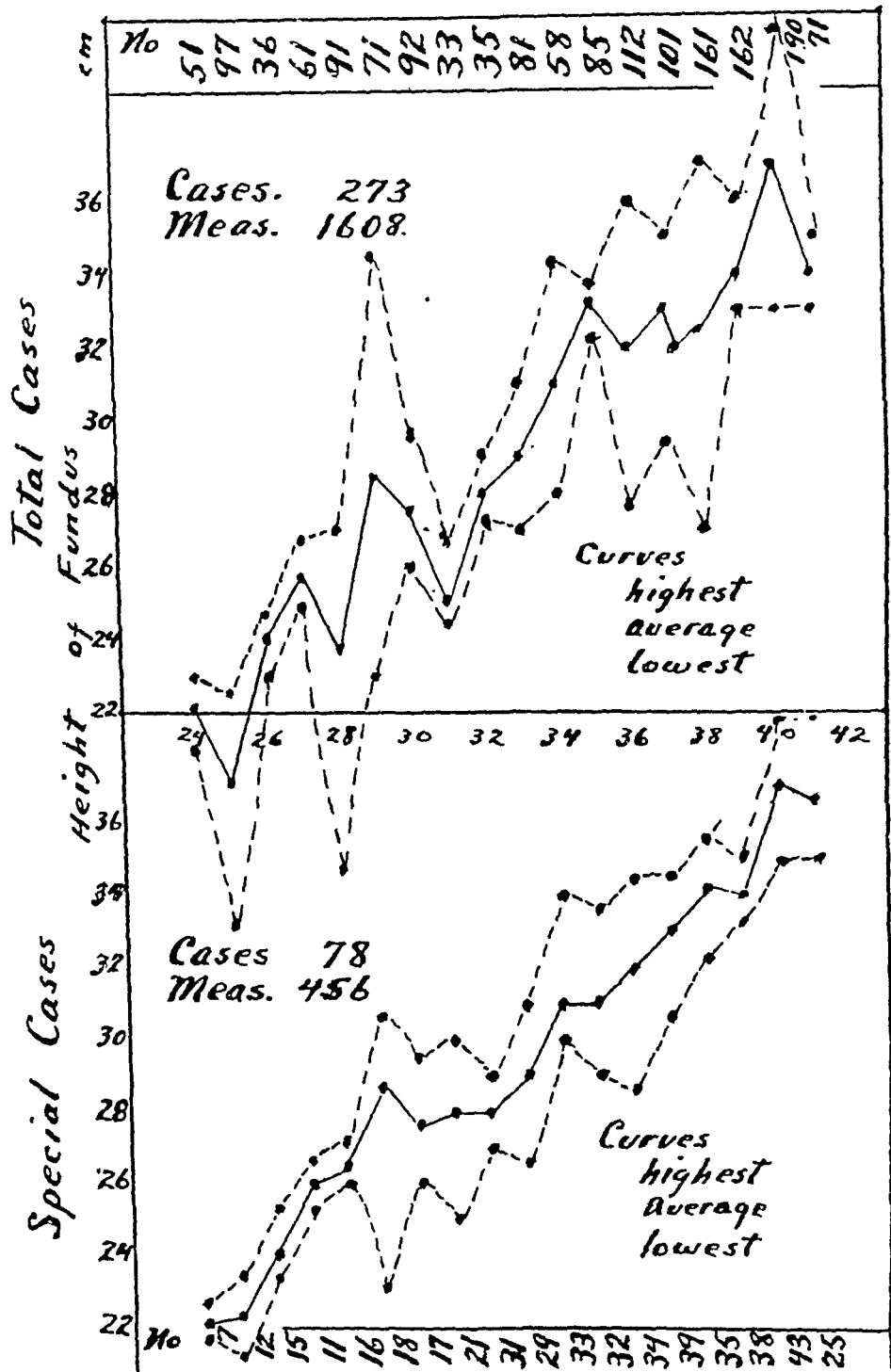


Chart IV.—O.R.A. Late. Presents special curves with less fluctuation and nearer the average in the center line throughout, which signifies a reliable curve with less chance of error, yet no better than O.L.A. or O.L.P., late curves.  
Of the positions coming late O.L.A. and O.L.P. are most reliable. O.R.P. is almost hopeless. Curves in special material clearly show the value of careful elimination.

necessary diagnosis. It is my postulation that many of the posterior vertex position present such conditions and the uterus depending on the outline of the fetus compensates accordingly. An occiput impinging on posterior obstruction causing partial extension of the head might account for the large variability found in posterior vertex estimations. Weak abdominal walls were always supported to present the fetus in the uterine axis and the center line of the mother. Lastly all cases were required to start into labor without any method of induction and came within two weeks of Nagel's prescribed rule.

Notice, in Table I, the close similarity between the number of early and late cases for each vertex position with the exception of O. L. A., conditions where the earliest predominate and the difference in each set of cases is exactly the same, i.e., 13.8 per cent. In the charts the ordinates represent the height of the fundus. The abscissae represent the weeks of pregnancy by Nagel's rule. The curves represent the highest, lowest, and average measurements while the cases used and the number of measurements are recorded on each individual chart. These chart curves show certain facts in common as follows:

1. Curves begin at the twenty-fourth week of pregnancy from which this particular study has been made so as to closely follow observations done in the past.
2. Most of the curves give one the impression that errors still exist even in special cases.
3. As weeks pregnant advance height of fundus increases more or less irregularly.
4. The average curve in special cases always assumes less irregularity in its ascension due to elimination of outside disturbing factors hitherto discussed.
5. Special cases have less irregular and closer high and low curves.
6. High and low curves approximate within 6 cm. in general material and 4 cm. in special cases.
7. As pregnancy increases high and low curves become more regular and closer to the average in special cases than in general cases, i. e., in late pregnancy measurements are probably more stabilized and less liable to extreme fluctuation.
8. Early curves are more irregular than in late pregnancy which is probably explained by the difficulty of diagnosing the position of the fetus during the early weeks of pregnancy when the fetal heart and fetal movements are the only guides to that position. In this series of cases when the fetal heart was found outside the imaginary vertical line bisecting the distance between the symphysis and the anterior superior spine it was classified as a posterior position, or when motion was felt inside that line it was called a posterior position.
9. Special cases are always more reliable than their corresponding total case chart.

Table I is a complete summary of early and late material in the various positions with the number of cases and measurements used. Following this is a detailed comparison of the rules of Nagel, McDonald, Spaulding and my own with the number of measurements predicting labor within two weeks and within one week. These calculations are then reproduced in percentage. Special cases with their careful expurgations develop into much better results. My rule is better by 5 per cent in two weeks and 10 per cent in one week pre-

TABLE I  
PREDICTION OF TIME OF LABOR  
COMPARISON NAGEL'S RULE, McDONALD, SPAULDING AND MY RULE

POSITION	CASES	PREDICTED TO 2 WEEKS			PREDICTED TO 1 WEEK			PER CENT TO 2 WEEKS			PER CENT TO 1 WEEK		
		Nagel	McD.	Sp.	My.	Nagel	McD.	Sp.	My.	Nagel	McD.	Sp.	My.
Total Cases													
O. R. P. Early	581	1432	878	812	888	1031	717	698	721	100	61.3	56.7	62.
Late	672	3555	2212	2192	2376	2737	2001	1991	2172	100	62.2	61.7	67.
O. L. P. Early	301	1626	1071	906	1084	1226	912	816	931	100	65.8	55.7	66.6
Late	294	1701	1072	1001	1074	1077	819	799	826	100	62.5	58.	63.5
O. R. A. Early	252	1422	892	891	948	1070	791	782	802	100	61.9	61.9	66.8
Late	273	1608	1071	989	1072	1396	921	903	942	100	63.7	58.9	63.7
O. L. A. Early	805	2812	1792	1718	1868	2110	1592	1521	1623	100	63.6	61.8	68.8
Late	609	3405	2261	2167	2270	3007	1961	1905	1969	100	66.7	63.7	66.6
Breech	231	1105	159	114	171	594	83	76	88	100	14.4	13.	15.5
Twins	91	580	0	0	0	427	0	0	0	100	13.5	0	73.6
Cesarean	89	420	279	258	280	298	172	170	183	100	66.8	61.5	66.9
Total	4198	19266	11687	11048	12031	14973	9949	9661	10257		54.8	55.3	60.7
Special Cases													
O. R. P. Early	166	831	572	495	676	640	554	326	610	100	68.7	59.6	81.
Late	192	1033	922	901	922	660	832	618	860	100	89.3	87.5	89.2
O. L. P. Early	86	473	462	282	465	319	428	324	431	100	97.5	69.5	98.4
Late	84	746	601	447	621	551	458	440	618	100	80.6	60.	83.3
O. R. A. Early	72	515	413	311	430	407	400	301	402	100	80.3	60.7	83.6
Late	78	456	356	273	380	374	318	252	328	100	78.1	59.9	83.4
O. L. A. Early	230	1128	1101	892	1108	980	752	675	940	100	98.1	67.3	98.2
Late	174	1321	1112	1022	1301	1040	881	792	1100	100	84.2	75.9	98.6
Breech	66	391	46	32	49	312	26	22	27	100	11.8	8.2	13.5
Twins	26	198	0	0	0	130	0	0	0	100	0	0	65.4
Cesarean	35	176	116	165	146	106	65	65	67		75.5	64.3	81.2
Total	1209	7268	5701	4790	6098	5519	4714	3815	5383		75.5	64.3	81.2
											61.5	59.5	68.9



## O.R.P. Early Less Than 2 Wks

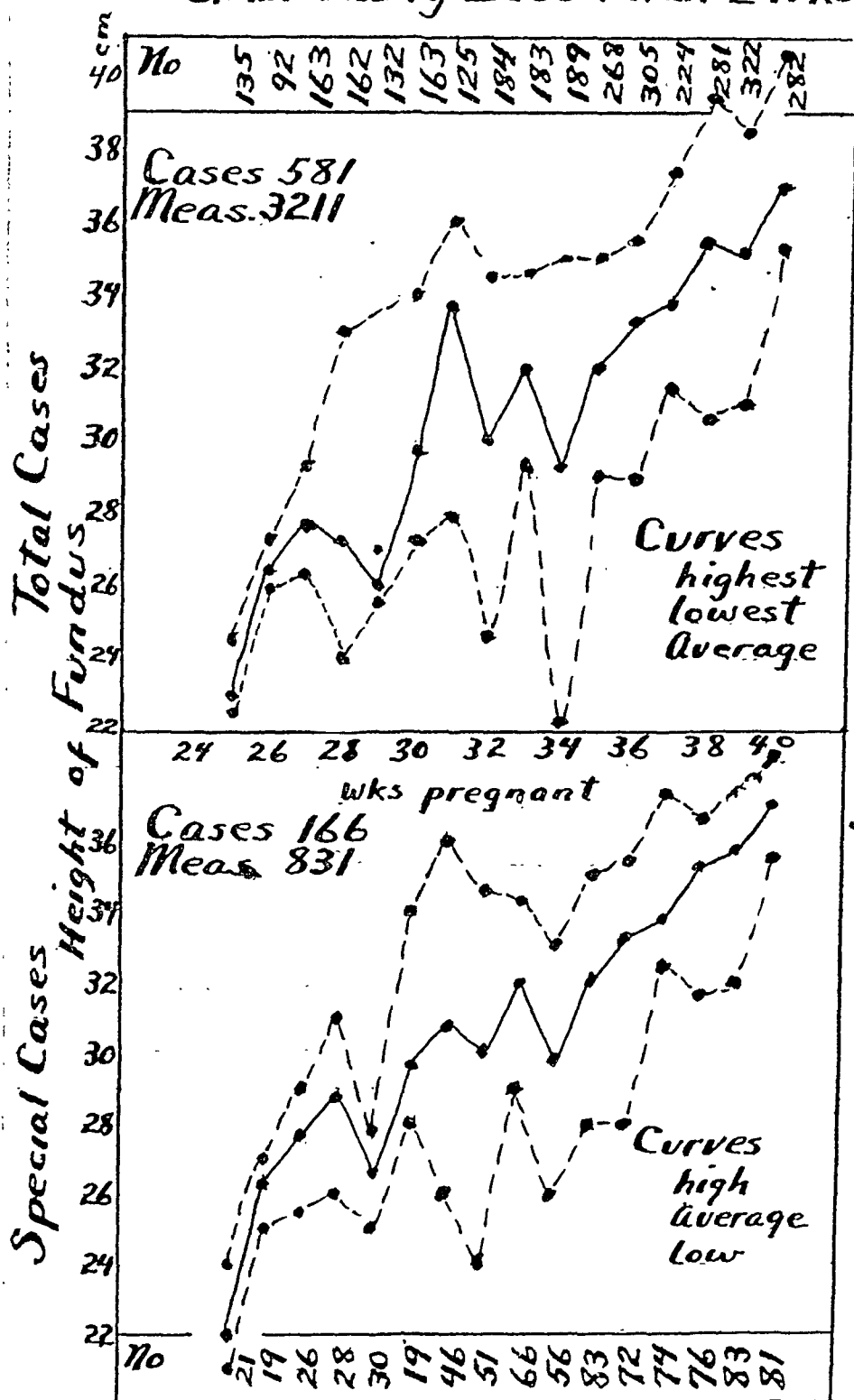


Chart V.—O.R.P. Early. Curves oscillate widely with the high and low far from the average which remains closely in the center line. The mean curves become more steady after the thirty-fourth week but the chart still remains very unreliable regardless of expurgations. Certainly no operative procedure should be considered when the McDonald measurement is the deciding factor.

O.L.P. Early Less Than 2Wks.

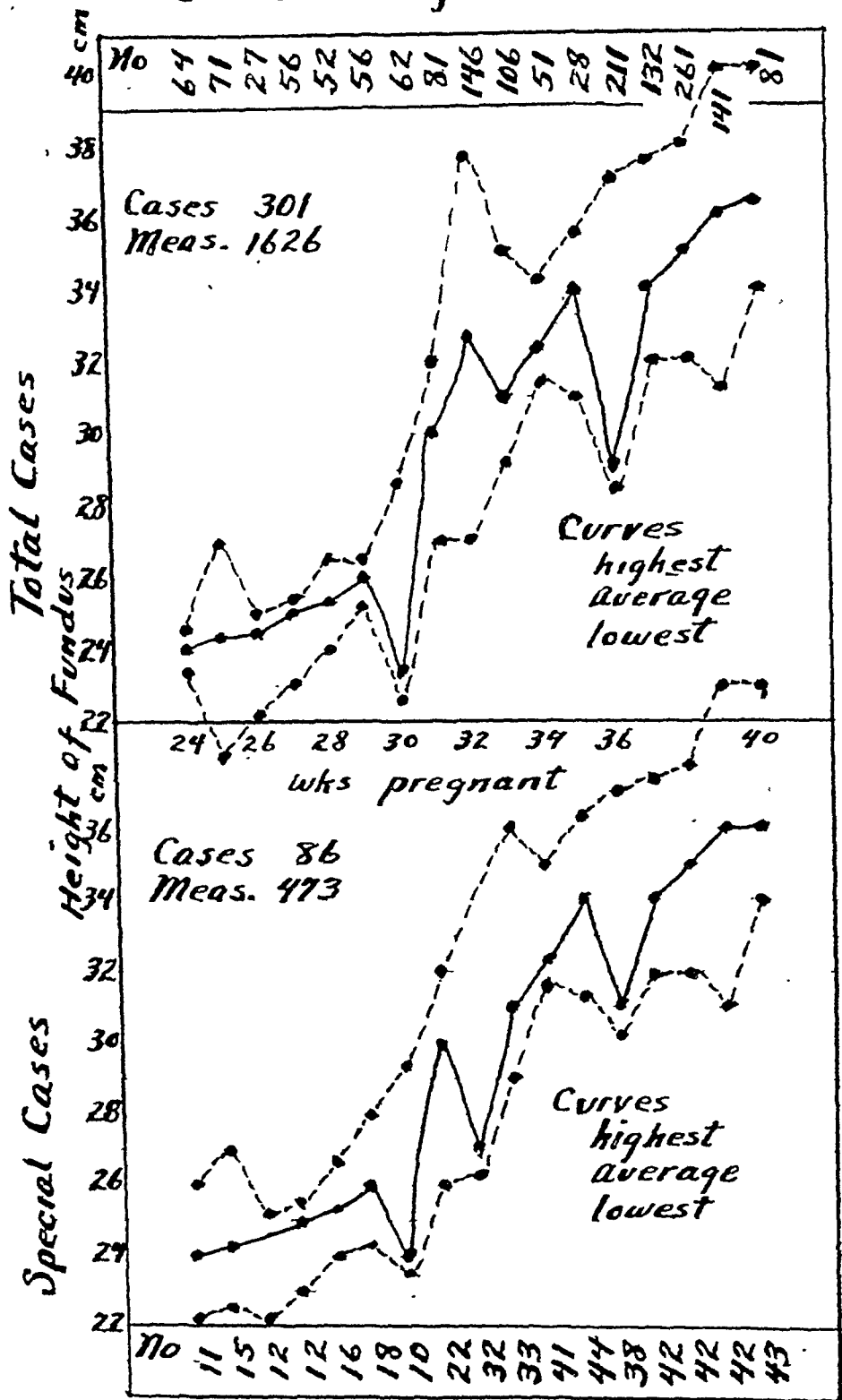


Chart VI.—O.L.P. Early. Presents an average curve closer to the low, fluctuating more widely than the high and low. This chart is more reliable than O.R.P. early with more measurements under than over the average. Even the special case chart fluctuates too widely to be a deciding factor for any operative procedure.

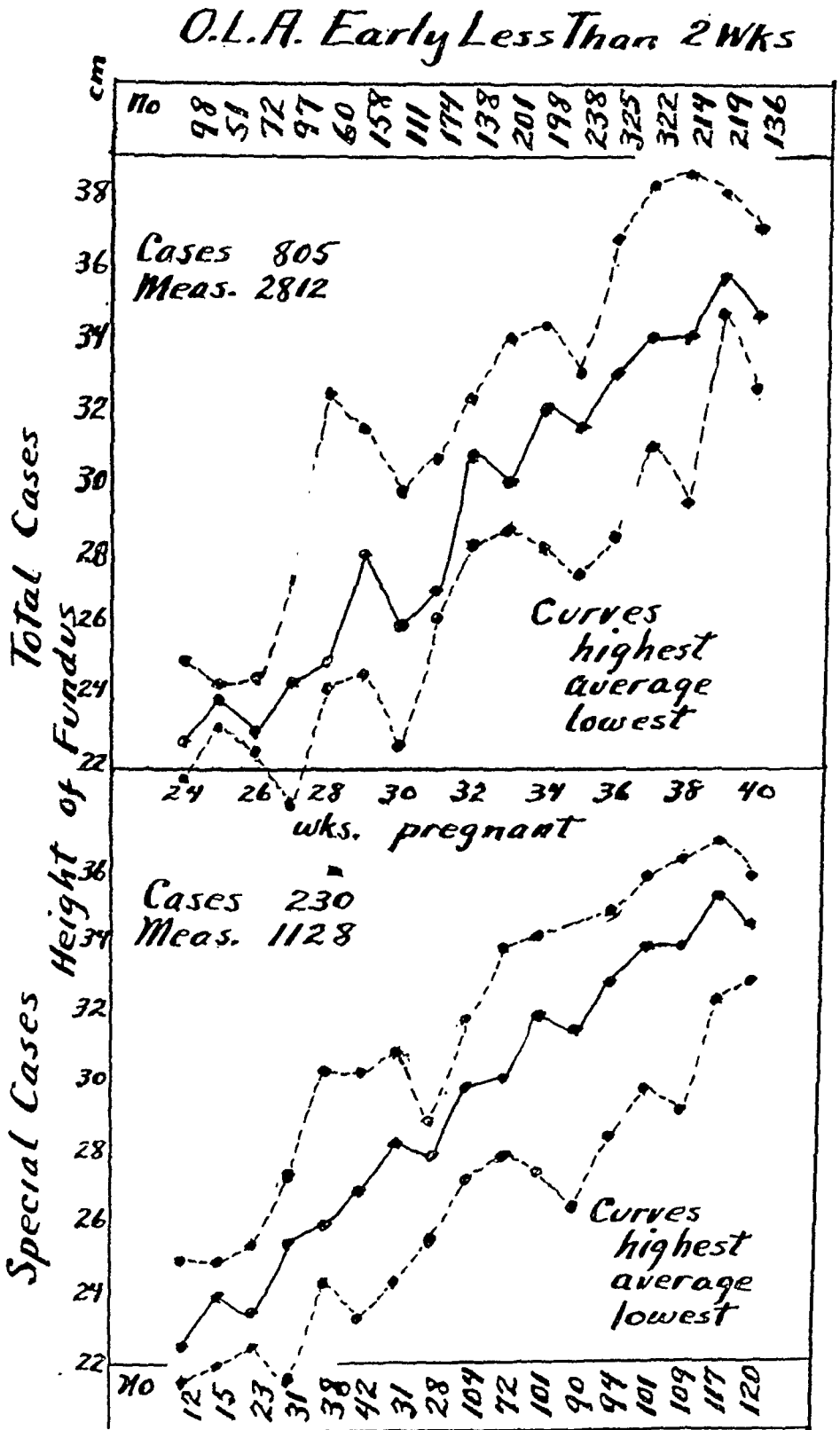


Chart VII.—O.L.A. Early. Curves are reasonably straight with most measurements closer to the high until the thirty-third week. This is a reliable chart with more numerous measurements slightly over the average.

O.R.A. Early Less Than 2 Wks.

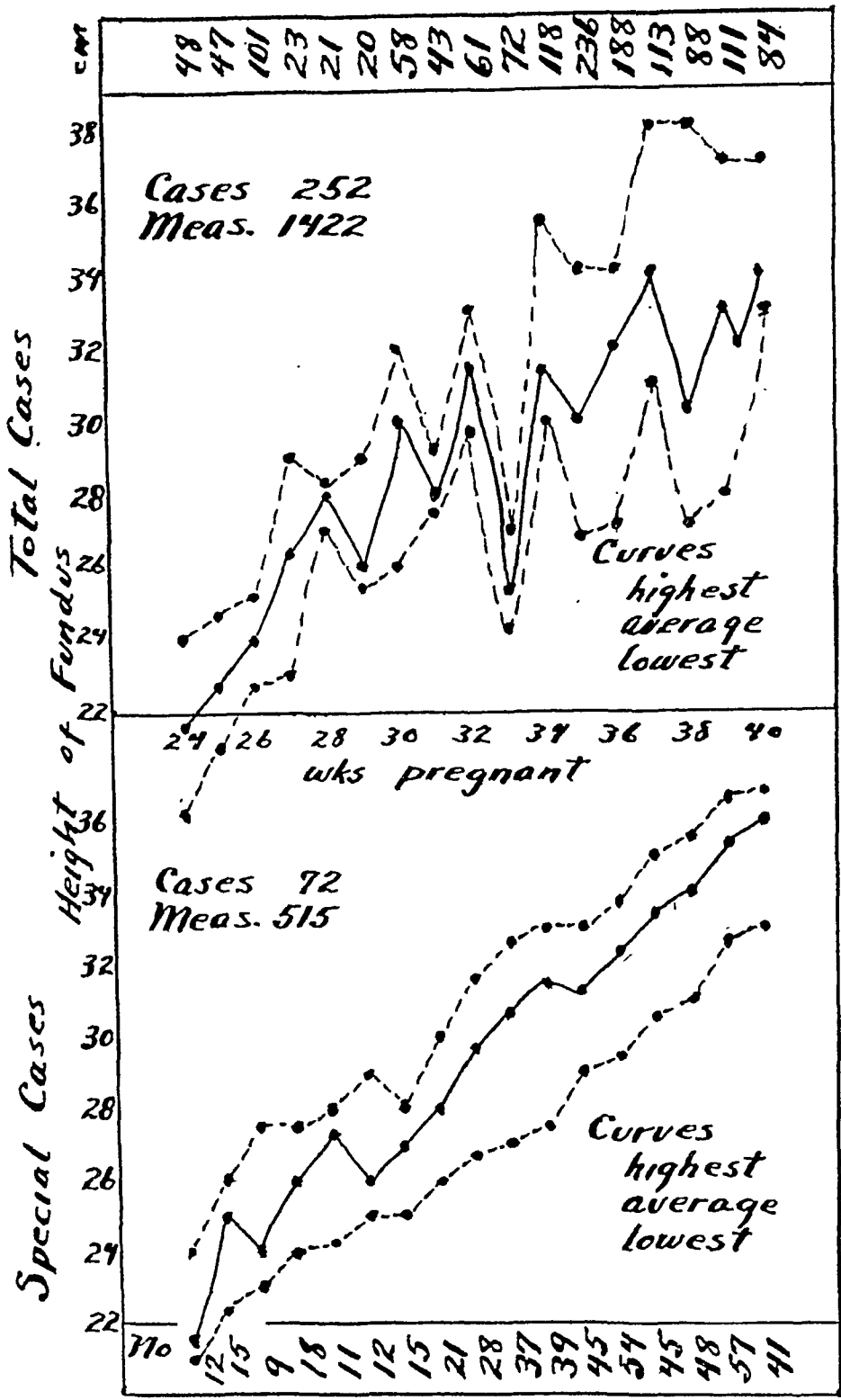


Chart VIII.—O.R.A. Early. Offers reliable high and low curves close together with the average closer to the low. It is very reliable and more apt to have a single measurement slightly below the average.  
In the late positions the occiput anteriors are the most reliable and the O.R.P. can be classed as hopeless for our purpose.

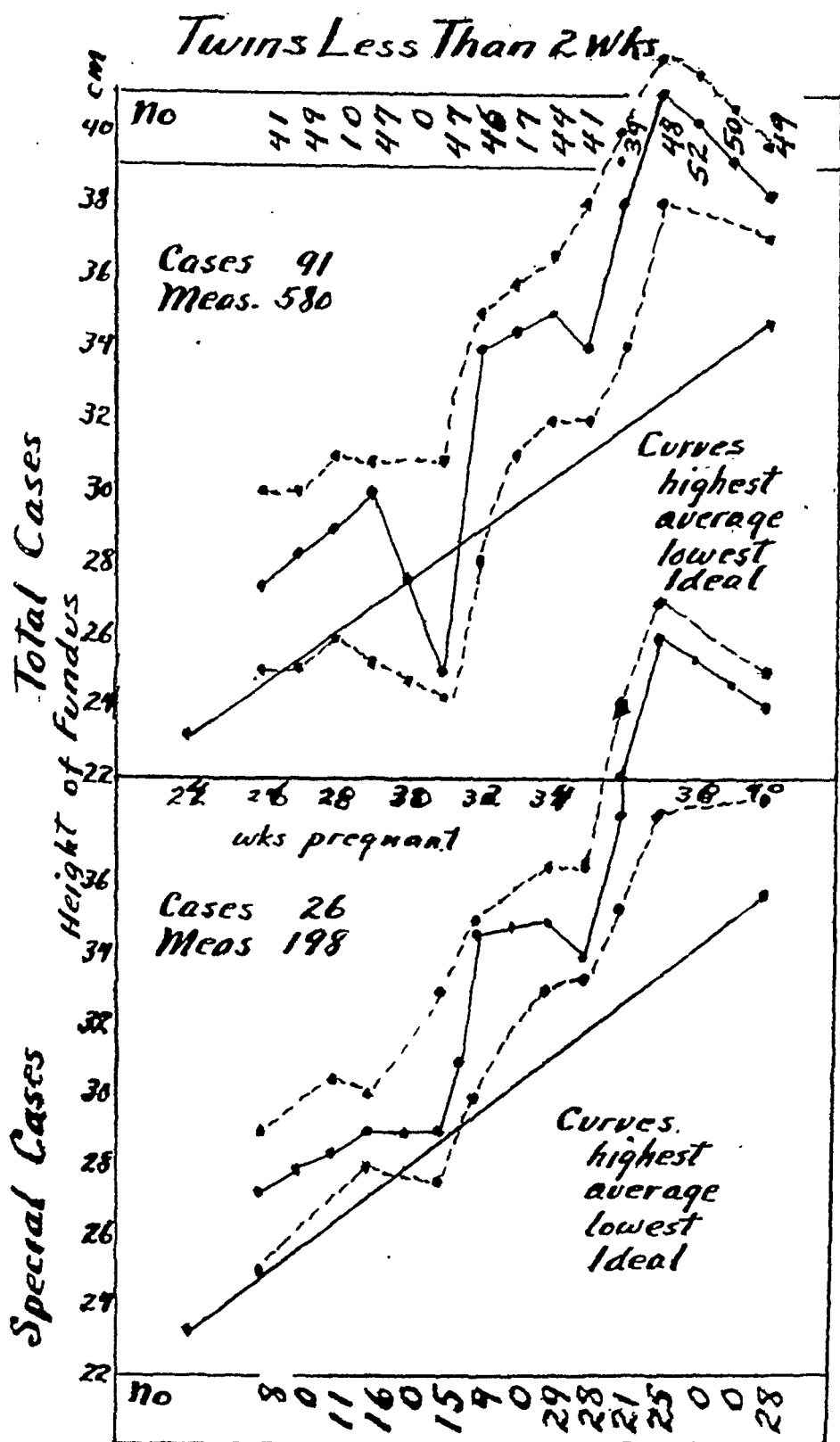


Chart IX.—Twins are all presented in one chart because of a small number. The irregular average curve ascends more sharply than vertex positions, while the high and low curves are reasonably uniform.

Twin measurements evidently vary widely without great uniformity. Their measurements are far above those of the vertex positions and should follow some rule of their own. They are presented here only as an illustration proving that multiparity should be eliminated from our predictions of the time of labor.

*Breech Within 2 Wks.*

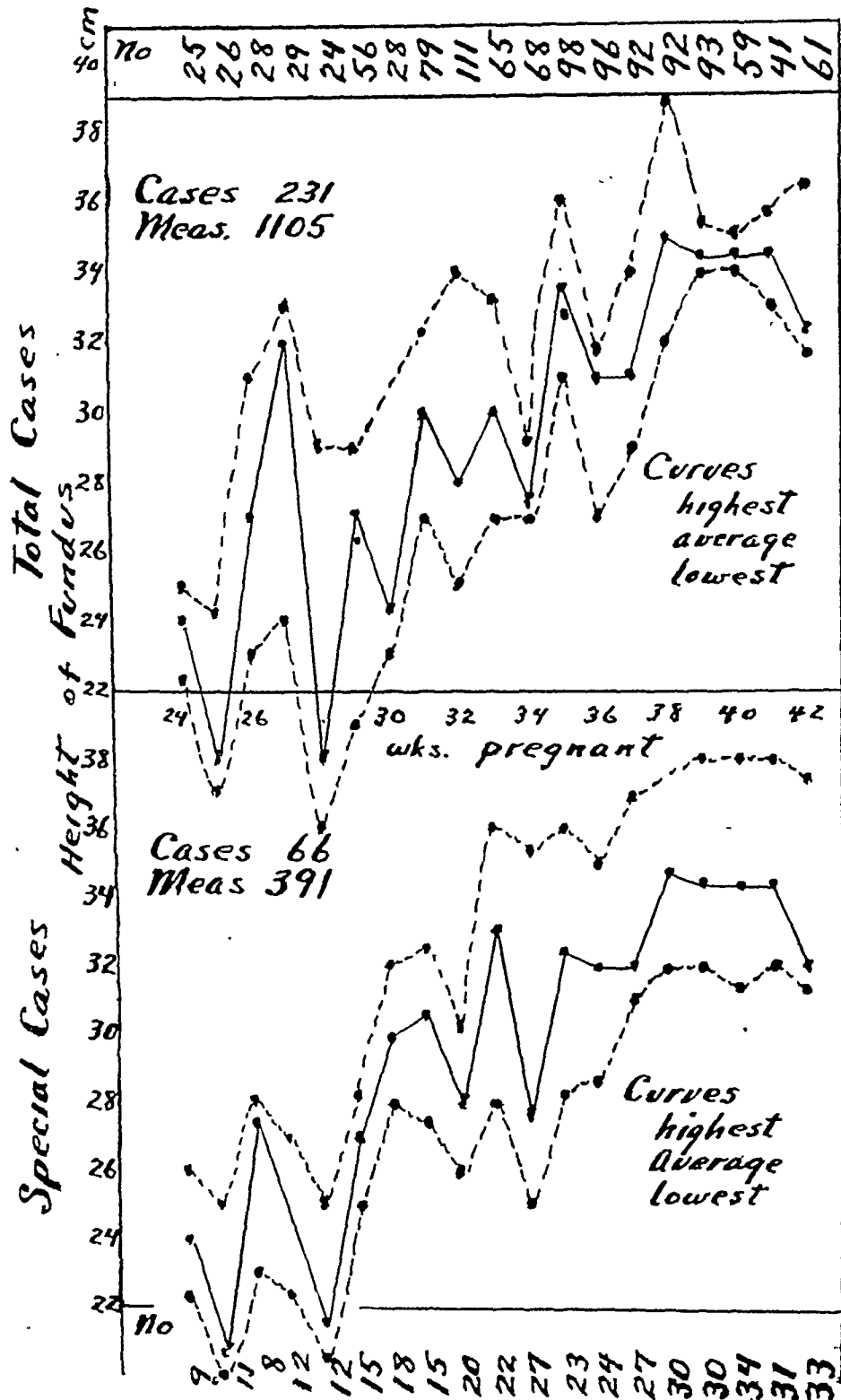


Chart X.—Breech curves are so irregular and fluctuate so widely that practical use of them does not seem fair to science. Such measurements are of no value even with careful elimination of material.

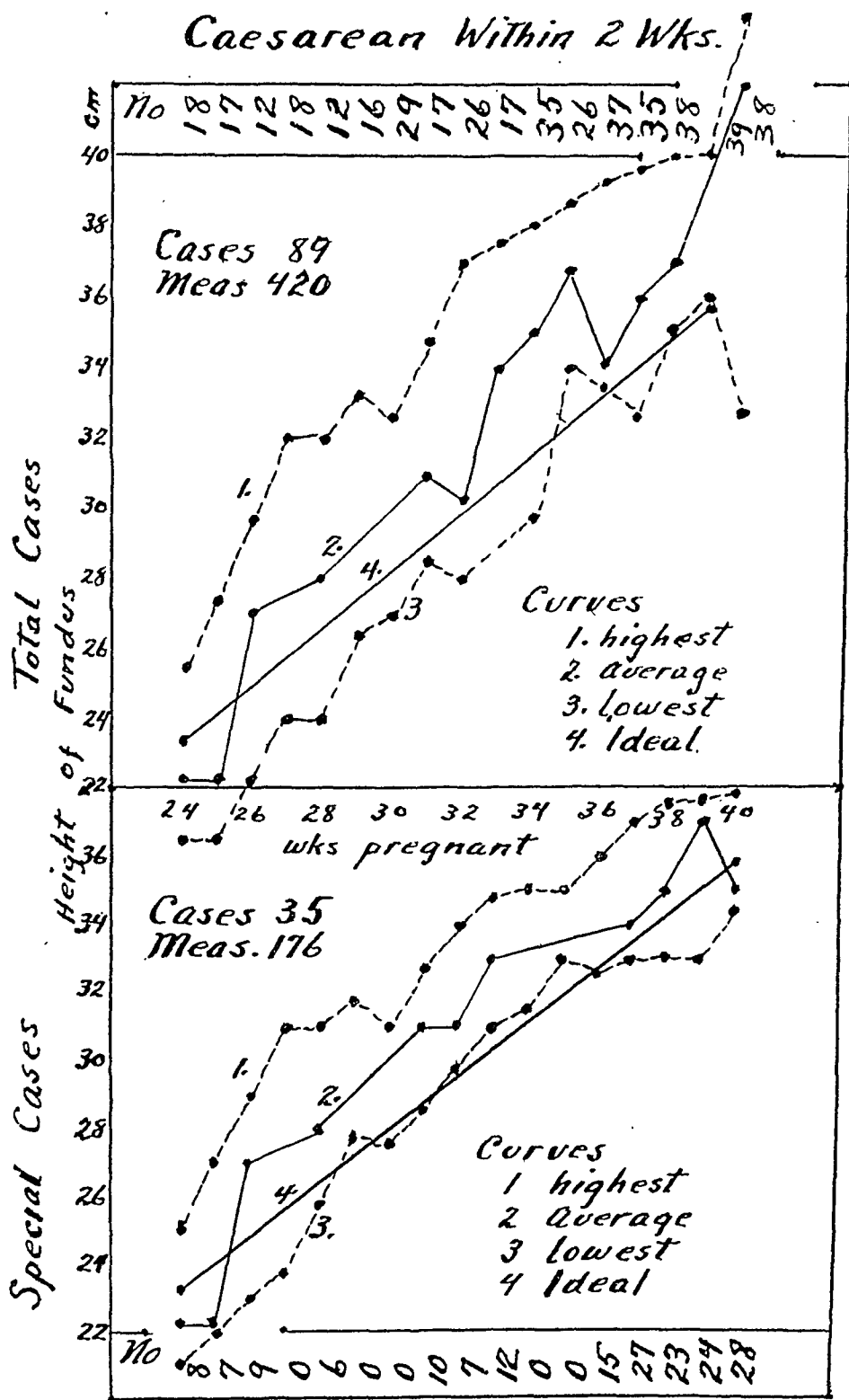


Chart XI.—Cesarean charts consist of all cases without engagement and were so studied for other purposes and include contracted pelvis cases as well as toxemias. The curves are orderly and the average is fairly straight, being somewhat over my ideal curve and reminds me of Spaulding's curve. This curve is too much over my ideal average to be of value, since this material was not carefully expurgated of the usual factors of error and the curve is somewhat like that of Spaulding's. I doubt whether he really used the same extreme care in his measurements.

dictions of labor and all rules are inferior to that of Nagel. Breech and twin measurements are of no value. Left-sided vertex positions are evidently most reliable and all can predict within 70 per cent of the time. With predictions of labor within one week my rule is almost as valuable as that of Nagel which is the only place wherein these two rules can be compared.

## SUMMARY

McDonald first publicly declared the value of this measurement and justly deserves its name. Spaulding published the only real

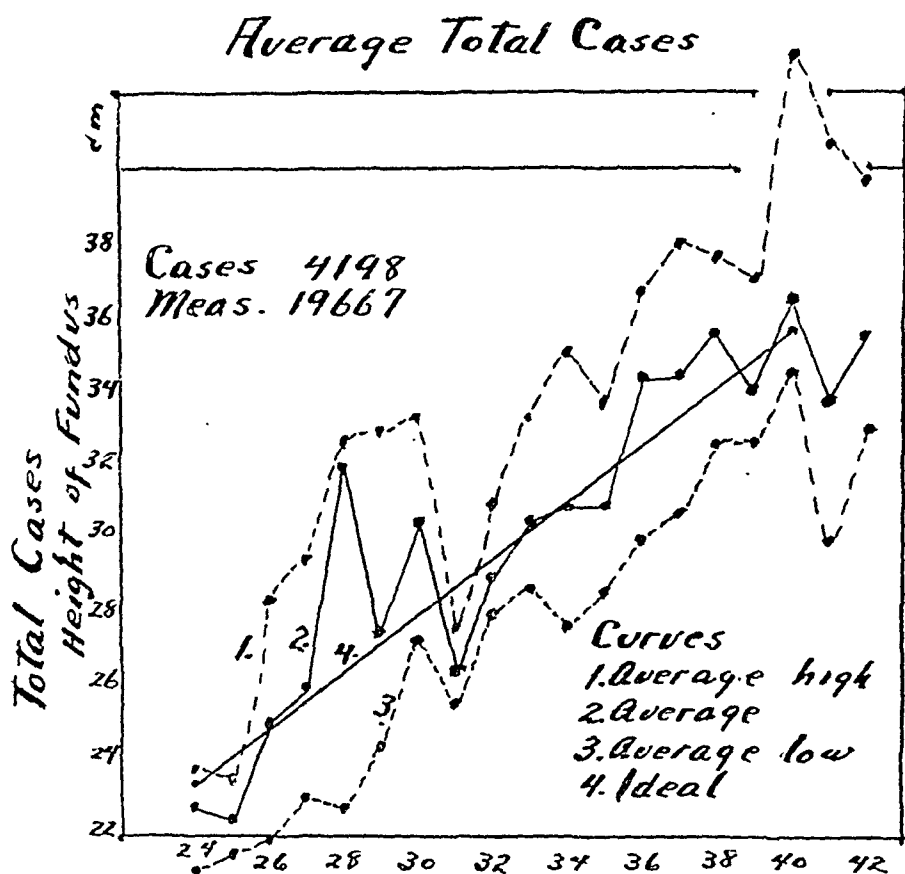


Chart XII.—The average chart of all cases is disappointing with very irregular curves up to the thirty-first week and still fluctuating badly thereafter. It represents many measurements by a variety of observers without more than ordinary care in eliminating undesirable factors. This chart is of no value except as a comparison with other charts.

statistical study. Their methods of measuring were practically the same and are followed by mine.

The normal vertex positions, breeches, twins, and a conglomerate mass classified as cesarean sections are used in this study. Breech and multiparity presented very unreliable measurements and were considered hopeless. Cesarean cases were offered to disprove Spaulding's declaration that the uterus has a changing rate of growth during pregnancy. The normal vertex positions gave fairly accurate results,



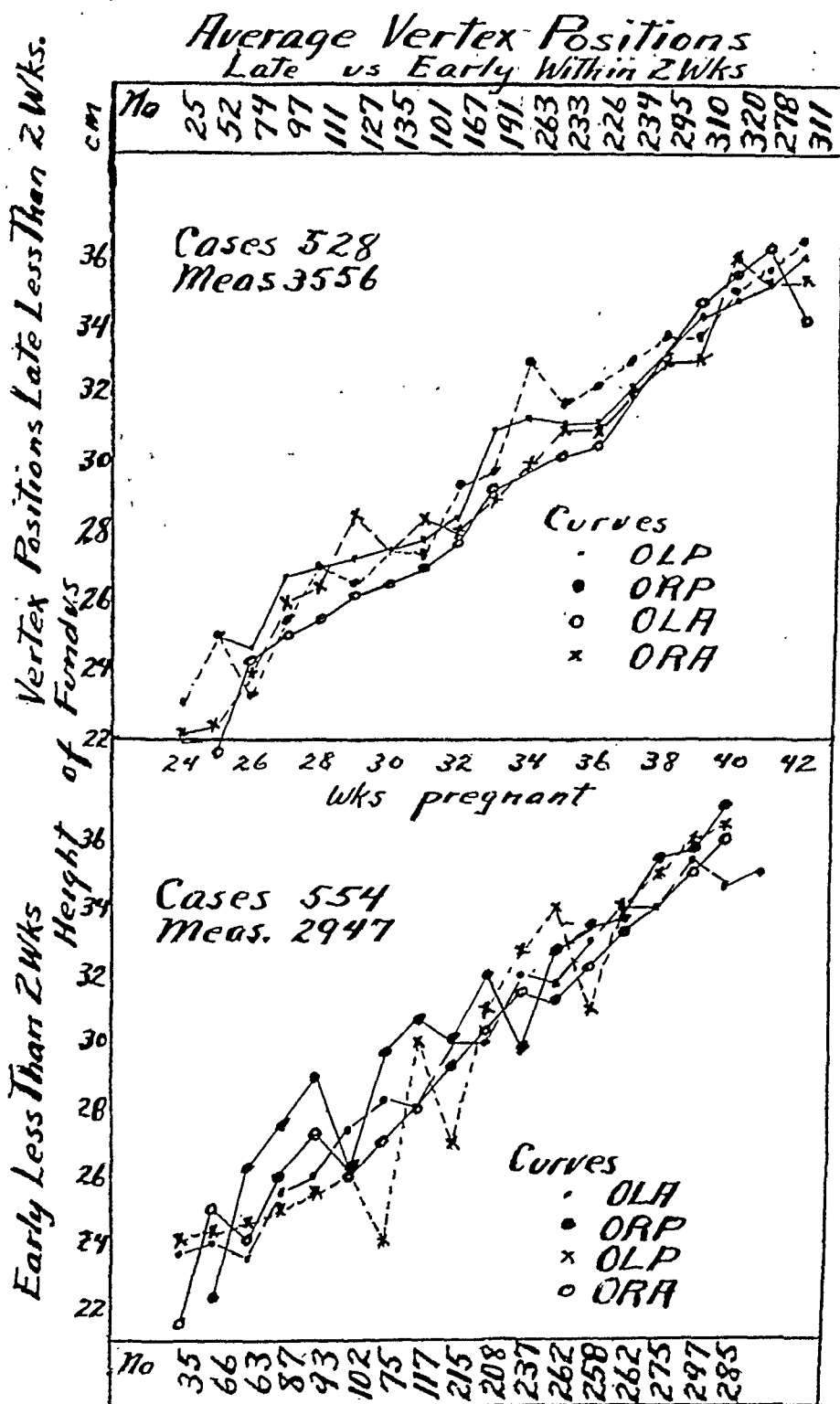


Chart XIII.—Interposed average curves of the early and late vertex positions of the special cases approximate closely. The average of these presents steady reliable curves with the early one predominating over the late curve as one would naturally expect.

# *Special Cases Average*

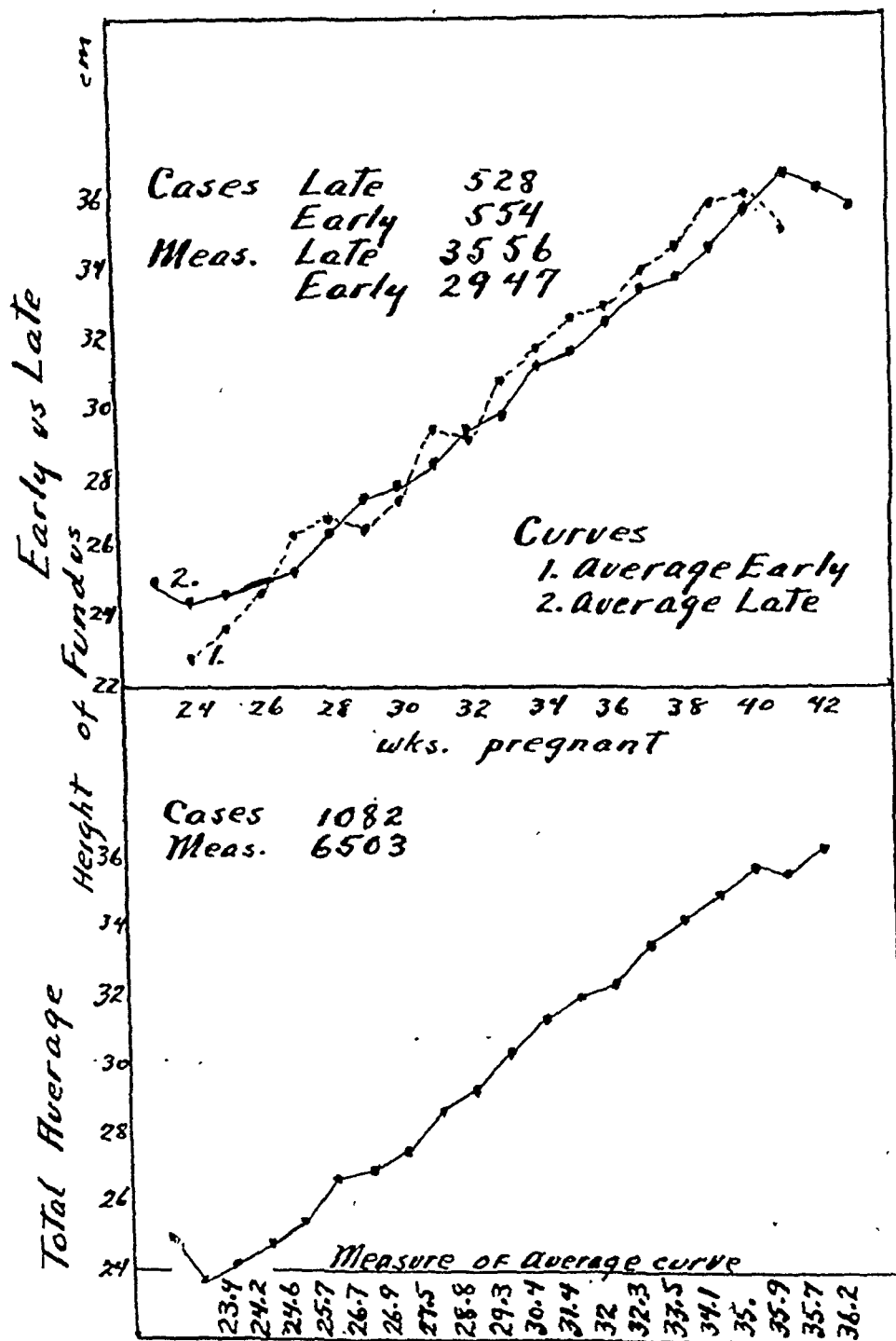


Chart XIV.—The general average has been calculated from the average curves of all the vertex positions wherein the number of cases in the early classification are about equal in number with those in the late and the resultant average is very close to a straight line.

the left side being more reliable than the right, and anterior positions were better than posterior ones. The latter allow the greatest variability and are therefore the least reliable. They fluctuate enough to be called too dangerous for use.

Abnormalities such as full bladder, full rectum, pelvic tumors, hydramnios, breech, multiparity, cord about the neck, abdominal adiposity, ascites, extension of fetal head or spine, all tend to cause oversize measurements, while careless measuring, lightening uterine contractions and uterine suspensions present shorter ones.

At present there is great error in predicting the probable date of

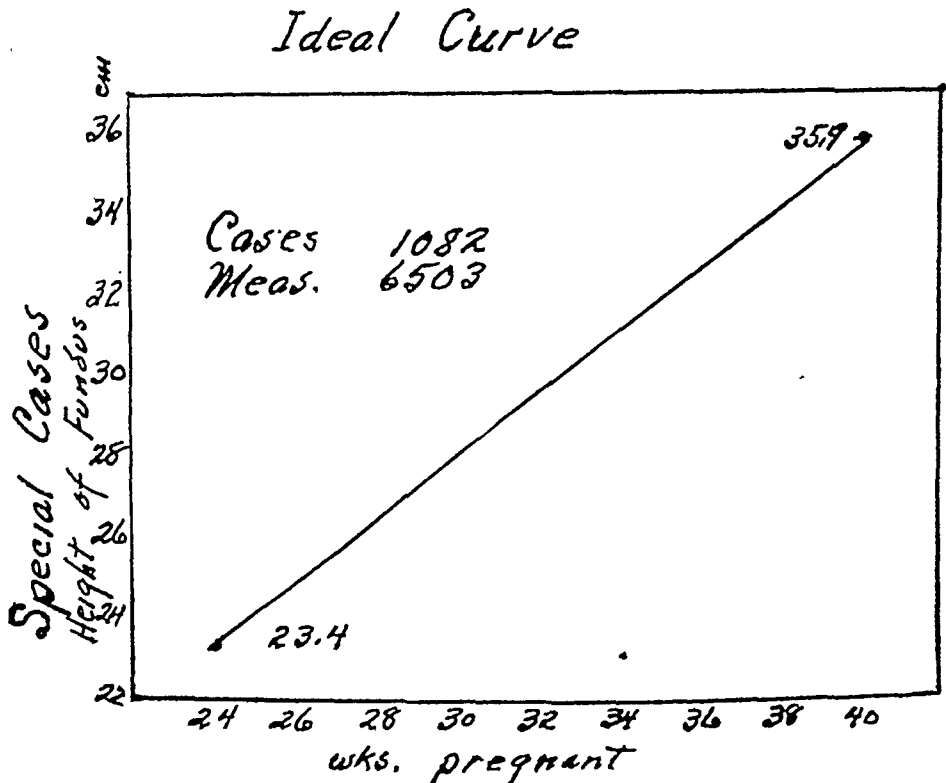


Chart XV.—I therefore present a straight line as nature's probable ideal curve, ascending from 23.4 cm. in the twenty-fourth week to 35.9 at the fortieth week with a definite regular rate of growth which has been so strongly denied by Spaulding.

labor. Nagel's rule missed 13 to 24 per cent. Height of navel from the symphysis varied 10 cm. in different women. Lightening with engagement is unusual and will not predict its proverbial two weeks before labor. Lightening is generally the result of abdominal relaxation without the fetal head engaging. Quickening varied from two to five months and was less accurate than Nagel's rule. McDonald misses in 40 per cent of his predictions. Spaulding is perhaps 10 per cent better. The Ahlfeld rule has not been considered here but has been reserved for future study.

Present formula relying upon statistics are not accurate due to careless measuring, meager materials used, unconsidered factors of error

and lack of appreciation of various positions and attitudes of the fetus. No one has compared all methods with one mass of material.

We present as new a greater set of measurements than ever before reported, another number personally measured to reduce the factor of error and a comparison of the two showing how one interested observer can decrease the measuring error. Various fetal positions have been studied separately and extreme care in eliminating sources of error were used. We freely admit a possible source of error in diagnosing the position of the fetus in early gestation. Furthermore well-known rules of foretelling labor have been compared with all our measurements. Assuming Nagel's rule as perfect (when in reality he varied greatly) we have checked all rules with his as to common fetal positions and whether the real labor occurred before or after

### *Ht of Fundus vs Wks. Pregnant*

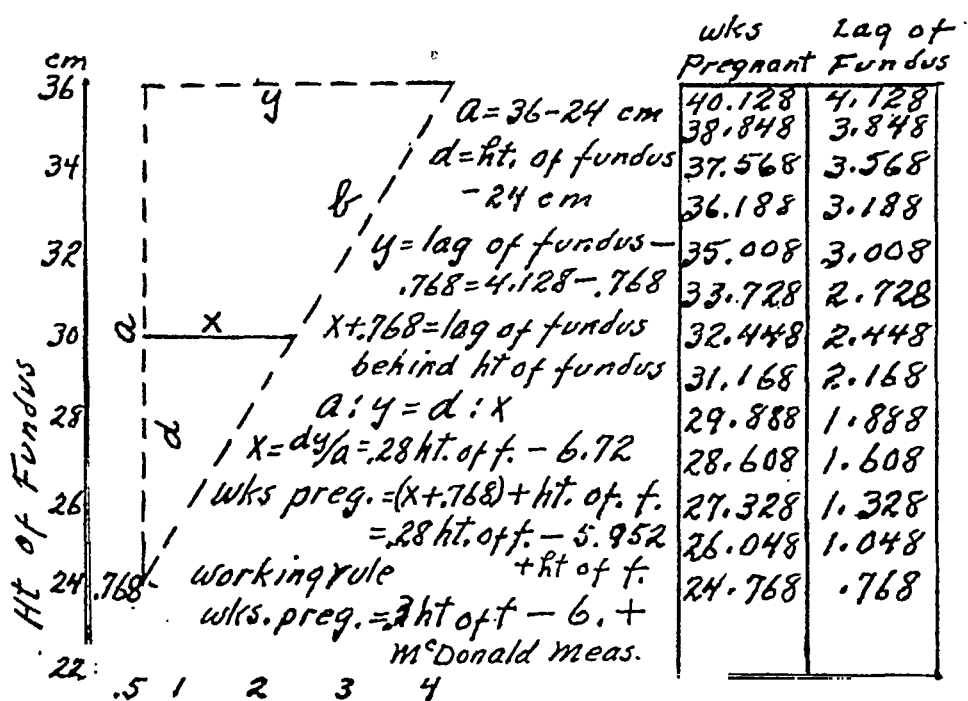


Chart XVI.—Height of fundus vs. weeks pregnant, represents the method of calculating the amount necessary to add to the McDonald measurement to find the number of weeks pregnant. The first column at the right represents the weeks pregnant for each McDonald measure above 24 cm., as represented on the ordinate at the extreme left. The last column tells the lag of the height of fundus behind weeks pregnant and is calculated by subtracting the height of fundus from the weeks pregnant. At the left, the ordinate of the triangle represents the height of fundus or McDonald's measurement and the abscissa corresponds to the lag of the fundus behind weeks pregnant as calculated in the second column. The line  $b$  represents the second column graphically starting with the 24 cm. McDonald at 0.768 and ascending to 4.128 at the 36 cm. McDonald measurement. Lines  $y$  and  $a$  complete a right angle triangle wherein line  $a$  represents McDonald measurements above 24 cm. and  $y$  plus 0.768 is the lag of the fundus behind the number of weeks pregnant.  $x$  represents an arbitrary line perpendicular to  $a$  at the point of any given McDonald measurement. Therefore, in any given McDonald, the line  $x$  plus 0.768 will equal the lag of the fundus behind weeks pregnant and when added to the McDonald measurement will equal the weeks pregnant. By the triangle we calculate that weeks pregnant equals 0.28 McDonald—5.92 plus McDonald which can be reduced to a working rule as follows:  $\frac{3}{10}$  McDonald—6 added to the McDonald measurement will equal the weeks in gestation. This working rule varies about three days from the ideal calculation.

his prediction. Lastly we present the postulation that abnormalities generally present overmeasurements and deny the reliability of occiput posterior positions.

We leave untouched statistics of the unusual true lightening cases with engagement and some formula for estimating the degree of descent because of the unreliable results obtained. The variability of the convexity of the uterus remains unproved. The differentiation between oversized babies and the abnormalities of pregnancy was eliminated in the original material chosen. Error in the position of the fetus in utero during early gestation probably remains uncorrected.

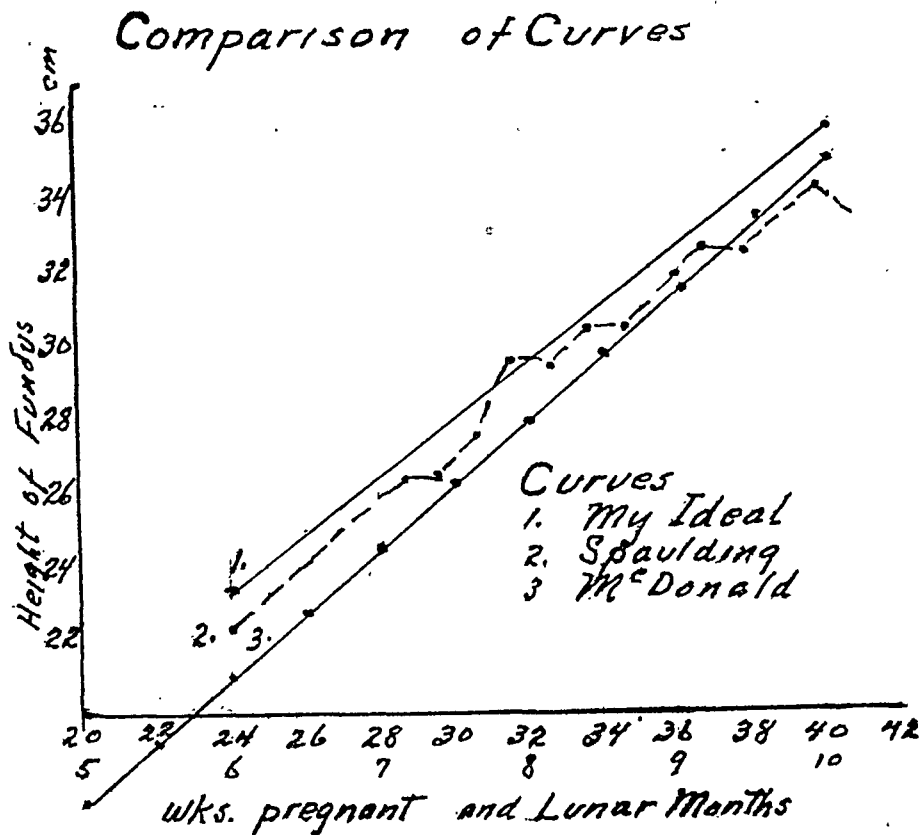


Chart XVII.—Comparisons of my ideal chart with McDonald, Spaulding and Nagel's rule show that McDonald and I agree that the fundus rate of growth is constant, which seems to fit present day theory that the uterus accommodates itself to fetal length which in utero has a definite increase each week according to the formula  $x + 5 \times 5$  equals length in cm. where  $x$  represents the months of gestation. McDonald and I refuse to recognize a drop in our curves from the thirty-ninth to fortieth week and mention lightening as an unusual condition. I believe Spaulding either did not skillfully estimate the degree of lightening or else he used measurements of the fundus with the uterus momentarily at rest while the patients were in labor, which in my observations often varied 8 cm. above or below my prelabor measurement.

The value centers upon the dependability which we claim is very good providing extreme care is used as to measuring and eliminating possible factors of error. All known or possible errors have been removed to arrive at a definite normal result. The various charts clearly show the difference between single careful measurements and multiple and often slovenly done determinations. Ability also centers

upon continual daily use of these measurements and will no doubt vary some with each individual. In the long run careful measurements are as good as Nagel's rule and each may vary as much as 24 per cent as to accuracy, hence our formula is a greatly to be desired check to cover up the deficiency of Nagel's predictions.

The best method is probably Nagel's rule because it can be determined from the beginning of and does not vary throughout pregnancy. It, however, is not very accurate varying in 5,500 cases from 87 per cent in two weeks to 81 per cent in one week predictions. Our formula in the long run will equal Nagel's predictions but has the disadvantage of being applicable only during the latter part of pregnancy and requires great care in discriminating abnormalities. It is an added tool to the skilled workman and useless junk to the occasional user. As an aid to Nagel's rule to decrease the 13 to 24 per cent chance of error it has been of great value.

I am indebted to many friends who have helped me gather this mass of material. I wish to thank Dr. Geo. Clark Mosher for the use of his clinical material and the valuable suggestions he has given during this study.

#### CONCLUSIONS

Labor can be predicted in a reasonable number of times by means of abdominal contour measurements, provided extreme care is used in eliminating the many possible factors which easily cause great error in results.

Such a method is dependable and as accurate as Nagel's rule after the twenty-fourth week and should be used in conjunction as an arbitrary check to that rule or when the menstrual history has been peculiarly unusual.

Accuracy of prediction depends upon the fetal position and attitude in utero being more reliable in leftsided vertex positions, and those cases coming earlier than Nagel's rule are more accurate than the ones occurring later. Posterior vertex positions are very unreliable and subject to great variability. Certainly no decision as to the method of procedure in an unusual posterior position should be decided by such measurements.

Abnormalities of pregnancy and labor present larger measurements than normal while careless measuring, lightening, uterine contractions and uterine suspensions generally give smaller ones. Undermeasurements are more valuable than overmeasurements because of less chance of error.

Measurements during labor are unreliable.

The uterus in gestation has a definite regular rate of growth throughout pregnancy.

Lastly this rule and abdominal contour measurements are of value only to those who use them daily and practice the art of obstetrics rather than occasional midwifery.

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BRYANT BUILDING.

# Department of Maternal Welfare

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CONDUCTED BY FRED L. ADAIR, M.D.

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## STANDARDS OF PRENATAL CARE

### AN OUTLINE FOR THE USE OF PHYSICIANS

*Approved by the Joint Committee on Maternal Welfare of the American Gynecological Society, American Association of Obstetricians, Gynecologists and Abdominal Surgeons, and American Child Health Association*

AT a meeting of the directors of the state bureaus of child hygiene held at the Children's Bureau in Washington in October, 1924, it was suggested that a committee from various parts of the country be appointed to draw up standards of prenatal care for the use of physicians at clinics and also those engaged in private work. The Children's Bureau accepted that suggestion and requested Dr. R. L. DeNormandie, of Boston, to form such a committee.

It consisted of Dr. Fred L. Adair, associate professor of obstetrics and gynecology at the University of Minnesota Medical School; Dr. Rudolph W. Holmes, associate professor of obstetrics and gynecology at the Rush Medical College, University of Chicago; Dr. Ralph W. Lobenstine, chairman of the medical advisory board of the Maternity Center Association of the City of New York; Dr. Frank W. Lynch, professor of obstetrics and gynecology, University of California Medical School; Dr. Florence L. McKay, director of the division of maternity, infancy, and child hygiene, Department of Health of the State of New York; Dr. James R. McCord, professor of obstetrics and clinical gynecology, School of Medicine, Emory University, Atlanta, Ga.; Dr. C. Jeff Miller, professor of obstetrics and clinical gynecology, Tulane University of Louisiana School of Medicine; Dr. George Clark Mosher, chairman of committee on maternal welfare, American Association of Obstetricians and Gynecologists; Dr. Otto H. Schwarz, professor of obstetrics, Washington University Medical School, St. Louis, Mo.; Dr. Annie S. Veech, director of the bureau of maternal and child health, State Board of Health of Kentucky; and Dr. R. L. DeNormandie, of Boston.

The committee appreciates that no group of physicians would agree without qualification upon any set of standards such as has been



attempted, but it does feel that the bulletin covers the essential points in prenatal care which all physicians should be called upon to give their patients.

This article as here printed has been adapted from a publication (153) of the Children's Bureau of the Federal Department of Labor and is also distributed by the Joint Committee on Maternal Welfare, from its office at 2500 Blaisdell Avenue, Minneapolis, Minn., where additional copies may be obtained.

#### STANDARDS OF PRENATAL CARE\*

Prenatal care is that part of maternal care which has as its object the complete supervision of the pregnant woman in order to preserve the happiness, health, and life of the mother and child. Therefore all pregnant women should be under medical supervision during their entire pregnancy, for it is only by careful routine prenatal care that pregnancy and labor can be made safer.

I. The physician at the first visit should obtain the following data and record the facts:

##### A. Patient's past history—

1. Diseases. Question particularly as to the following:

- (a) Tuberculosis or exposure to tuberculosis.
- (b) Scarlet fever.
- (c) Tonsillitis.
- (d) Rheumatism.
- (e) Diphtheria.

2. Surgical conditions and accidents, especially abdominal and pelvic operations.

3. Menstrual history—cycle, amount of flow, duration, and pain.

B. Character of previous pregnancies and labors. Secure the following data of previous pregnancies in chronologic order:

1. Date of termination.

2. Period of gestation.

3. Complications during pregnancy.

4. Labor.

(a) Onset—spontaneous or induced.

(b) Character.

(c) Duration.

(d) Termination of labor.

Spontaneous or artificial.

If artificial, what method.

(e) Other complications.

5. Puerperium.

(a) Infection.

(b) Hemorrhage.

(c) Operations following.

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\*No attempt has been made in this pamphlet to direct actual treatment, particularly for such conditions as nausea or vomiting, preeclamptic toxemia, and the treatment of syphilis during pregnancy. The physician using this outline is referred to standard works in obstetrics and other branches which deal adequately with these phases of the work.

## 6. The newborn.

- (a) Alive or dead at birth.
- (b) If dead, macerated?
- (c) Premature or term.
- (d) Breast fed—yes or no. Duration.
- (e) Baby alive now? If dead, give cause of death.

## C. Present pregnancy:

- 1. Date of last menstruation and character thereof.
- 2. Nausea and vomiting and quickening.
- 3. Estimation of date of delivery.

## II. Then proceed to—

## A. Physical examination.

- 1. Taking and recording of the systolic and diastolic blood pressure, temperature (preferably P.M.), pulse, and weight.
- 2. Skin, nutrition, head, mouth, neck, chest, heart, lungs, breasts, extremities.
- 3. Abdominal examination, palpation, auscultation, mensuration.
- 4. Vaginal examination. No vaginal examination during the last month of normal gestation without strict aseptic precautions. Rectal examination should be substituted.

(a) The necessity of a vaginal or rectal examination is insisted upon—

- (1) To determine the existence of a pregnancy.
- (2) To determine the position of the uterus.
- (3) To discover any pelvic tumor.
- (4) To determine the presence of venereal disease, and if suspected to take smears.
- (5) Speculum examination of the cervix and vagina is advised in early pregnancy if indicated.

(b) In presence of vaginal bleeding at any period of gestation only rectal or aseptic vaginal examination should be made.

## 5. Pelvic measurements.

- (a) Intercristal.
- (b) Interspinous.
- (c) External conjugate.
- (d) Diagonal conjugate.
- (e) Transverse diameter of the outlet.
- (f) Palpation of pelvic contours, promontory, sacrum, coccyx, ischial spines, arch, tuberosities.

## 6. Taking of blood for Wassermann reaction.

## 7. Urinalysis.

Specific gravity. Albumin. Sugar.

A microscopic examination of the sediment is advisable as a matter of routine, and it is a necessity if albumin is present. If there is any evidence of trouble, a 24-hour specimen should be secured.

III. If pregnancy is determined, then give minute instructions to the patient in the hygiene of pregnancy.

- A. Diet.
- B. Exercise, rest, sleep, and recreation.
- C. Clothing, including shoes.
- D. Baths and care of the skin.
- E. Care of the bowels.
- F. Care of the kidneys.
- G. Care of the teeth.
- H. Care of the breasts.
- I. Intercourse during pregnancy.
- J. Maternal impressions.
- K. Hygiene of the home and preparation for home delivery.
- L. Mental hygiene.

Patient should be examined by a physician at least once a month during the first six months, then every two weeks or oftener as indicated, preferably every week in the last four weeks. A properly qualified nurse working in conjunction with a physician may assist in the observation of the patient. At each visit to the physician the patient's general condition must be investigated, blood pressure taken and recorded, urinalysis done, pulse and temperature recorded, and the weight of the patient taken if possible.

External pelvimetry is only suggestive. It alone does not determine whether or not any disproportion is present. Abdominal examination should be made at each visit and the height of the fundus be determined at this examination. Abdominal palpation in the eighth and ninth months will show whether or not there is any obvious disproportion between the head and the pelvis. Malpositions can be determined and may be corrected. Further information as regards descent and fixation can be obtained by rectal examination.

In a primigravida, if the presenting part two weeks before the estimated date of delivery is not well in the pelvis, the physician in charge should determine, so far as is possible, whether any disproportion between the pelvis and the baby exists. If a disproportion is diagnosed in any case special care should be taken to avoid vaginal examinations immediately prior to or after the onset of labor. This precaution is wise because of the danger of serious infection should operative procedures later become necessary.

Every patient requires careful individual study. If the prospective labor offers a probable chance of being a difficult one, the patient should be sent to a well-equipped hospital for delivery.

Pregnancy is a physiologic condition, but there is no condition which may become pathologic more quickly. It is therefore necessary to instruct each patient at her first visit to report at once to the physician anything that may affect her well-being, especially the following symptoms:

1. Obstinate constipation.
2. Shortness of breath.
3. Acute illnesses, especially colds, sore throat, and persistent cough.
4. Persistent or recurring headache.
5. Recurring nausea or vomiting.
6. Visual disturbances.
7. Dizziness.
8. Pain in the epigastrium.
9. Edema, especially of face, hands, and ankles.

10. Changes in the urine or in the type of micturition.
11. Severe pain in the lower abdomen.
12. Vaginal bleeding, even the slightest.

In case of vaginal bleeding or low abdominal pain the patient must be instructed to go to bed at once and to send for her physician. When bleeding from the vagina occurs its source must be determined by examination. When hemorrhage appears imminent the patient, if possible, should be removed to a hospital, but if vaginal examination is necessary it must be done under aseptic precautions. Where a hospital is not available, means must be at hand to control the possible severe bleeding that may arise.

If the patient develops a toxemia in the course of her pregnancy it is only by careful medical supervision and treatment that an eclamptic condition can be prevented. Eclamptic convulsions are in the majority of cases preventable, but only by constant vigilance combined with cooperation between the patient and the physician can the disastrous results which occur throughout the country be diminished.

If the patient is to be delivered by a licensed midwife, she should have the advantage of the same prenatal care to which all prospective mothers are entitled. If there is doubt about the patient's having a normal delivery she should be transferred to a doctor or to a hospital.

Only by careful study of each case is it possible to determine whether the patient should be allowed to stay at home or be sent to a hospital. By this individual study the number of vaginal examinations during labor may be cut to the minimum and the terrible toll of death from sepsis be much lowered.

It is only by the early and repeated examination of the prospective mother that the premature termination of pregnancies, the stillbirths, and many diseases and deaths of the newborn can be reduced. By the same methods the mothers can be spared much distress and disease, and many lives can be saved which would otherwise be lost from toxemia, accidents of pregnancy and labor, and infection.

# Society Transactions

## THE AMERICAN GYNECOLOGICAL SOCIETY

### FIFTY-FIRST ANNUAL MEETING

STOCKBRIDGE, MASS., MAY 20, 21, AND 22, 1926.

DR. PALMER FINDLEY, Omaha, Nebr., read a paper on **Pregnancy in Uterus Didelphys**. (For original article see page 318.)

### DISCUSSION

DR. CHARLES M. GREEN, BOSTON, MASS.—I can add nothing to this discussion; for I have seen no case of complete uterus didelphys which was pregnant. One perfect case of complete duplicity, from fundus to introitus vaginae, I have seen, however, which was not pregnant. There was a gonococcus infection in one side.

DR. HIRAM N. VINEBERG, NEW YORK CITY.—I am sorry I did not receive a questionnaire because I could have added two cases of double uterus with pregnancy. The first woman went to full term. She had had several pregnancies, one in one uterus and the next in the other, alternating. I saw her also in a case of miscarriage.

A private patient of mine I delivered twice. Both pregnancies went to full term without any difficulty. In the first delivery about the fourth day, the temperature went up to 101.6 and on examination I found that there was considerable decidual tissue in the nonpregnant uterus and when that was removed with the finger the temperature promptly fell.

DR. REUBEN PETERSON, ANN ARBOR, MICHIGAN.—I have had four cases of double uterus in three of which the patients had been pregnant.

The fourth patient was a girl of fourteen. This case illustrates the difficulties of diagnosis mentioned by Dr. Findley. By rectum could be felt what I considered an ovarian cyst but which laparotomy revealed to be a hematoma of considerable size. Before the diagnosis was definitely established, I had done so much damage to the pelvic organs that I was compelled to do a hysterectomy to save her life.

I here present the specimen of a double uterus with one cervix where eight pregnancies had occurred on one side. This double uterus was removed for carcinoma of the cervix. The other uterus is small and atrophic.

I have had two other cases where pregnancy occurred in a double uterus, always on one side, although cases have been reported where pregnancy has taken place on both sides. In one case a cesarean section had been performed, the reason for which could not be ascertained.

I have never seen a case of double vagina or complete doubling of the genital tract in which pregnancy had occurred.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—These cases of doubling of the genital tract are particularly interesting. We have recently seen three cases, since reporting our cases to Dr. Findley, two of didelphys, one of which is now preg-

nant four months. This woman had an infected cyst at the lower portion of the vagina which gave rise to intense inflammatory symptoms. This cyst was drained. On exploration this cyst led to an undeveloped cervix and uterus. The other vagina was well developed and led to the pregnant half of the didelphyic uterus.

There are two points I would like to make: first, the difficulty of diagnosis for as a rule these cases present no symptoms until they get married, become pregnant or are infected. Secondly, they behave badly following delivery or miscarriage. They often have menstrual disturbances as a result of the bad drainage and from the decidual reactions which occur in the horn which is not the seat of the pregnancy.

A third point is that a rudimentary horn will give rise to all sorts of complications. I had one patient 14 and another 16, both of whom developed hematometra in the rudimentary horn and a pelvic abscess requiring drainage.

DR. SIDNEY A. CHALFANT, PITTSBURGH, PA.—I would like to mention one case that shows the value of conservative surgery in these cases. Some years ago we saw a patient with double uterus, double vagina and pus tube on the right side. I removed the tube and ovary and right uterus. About three years later we saw her at the clinic about three months pregnant. Unfortunately, the patient moved from the city when about five months pregnant, so I cannot state the final outcome.

DR. BARTON COOKE HIRST, PHILADELPHIA, PA.—There are two other cases I would like to add. One I saw in consultation. The physician was in a distracted state of mind. He would find a far advanced labor in one examination and then no progress at all in another. The woman had a double vagina and a uterus didelphys. She was delivered spontaneously.

The other patient had atresia of one vagina and an enormous hematocolpos reaching up to the umbilicus, with the two halves of a uterus didelphys perched on top of it; both uteri underdeveloped.

A third case which I reported to Dr. Findley, I left undelivered in Philadelphia, although due. There is a breech presentation and I have recommended cesarean section.

DR. HENRY T. BYFORD, CHICAGO, ILL.—In my own experience in my younger life as an assistant and then later operating myself, I have come across quite a number but never have seen a case that became pregnant. I think a great many of these cases that do not become pregnant, have never been diagnosed, and the proportion of pregnancies may not be so great as the Doctor's investigations seem to indicate.

DR. C. JEFF MILLER, NEW ORLEANS, LA.—I have opened the abdomen in two cases of uterus didelphys which demanded interference. It is sometimes difficult, even with the abdomen open, to determine which uterus should be removed. In one instance the patient suffered from menorrhagia, and was particularly desirous of having children. I found both uteri apparently well developed, and both ovaries showing slight cystic changes. I closed the abdomen without removing anything, because I felt her chances for children were better without interference. Three days before I left home I operated on another of these cases, in which the chief trouble was dysmenorrhea and metrorrhagia. Laparotomy revealed a large hematocolpos in one side, which made it clear that the metrorrhagia was due to the opposite side. In this instance it was necessary to remove both uteri. I am not inclined to interfere in these conditions as frequently as some authorities advise, and I never operate unless urgent symptoms warrant it.

*(To be continued)*

## NEW YORK OBSTETRICAL SOCIETY

MEETING OF MAY 11, 1926

THE PRESIDENT, DR. O. PAUL HUMPHSTONE, IN THE CHAIR

DR. H. N. VINEBERG reported a case of **Early Ovarian Pregnancy Associated with Uterine Pregnancy**. (For original article see page 332.)

DR. L. L. FULKERSON (by invitation) read a paper entitled **Endocervicitis. A Review of 1,039 Cases, Some Treated with the Cautery**. (For original article see page 374.)

### DISCUSSION

DR. H. B. MATTHEWS.—I would say that the incidence quoted (33 per cent) seems a little bit low. In our work at the Long Island College Hospital and in private practice, covering several hundred cases, 75 per cent showed evidences of endocervicitis.

As regards backache: I believe that chronic endocervicitis is a definite cause for backache, for in those cases treated either by the cautery or by operation, but more particularly by operation, the backache, as well as the leucorrhea, has been relieved.

There are four ways of treating chronic endocervicitis. The antiseptic treatment was credited with 12 per cent of cures, which I would say is entirely too high. The cautery treatment in the superficial infections following childbirth, the early post-partum cases, from 3 to 15 or 20 months, cures a very large percentage. We followed 226 of those cases, and 70 per cent were relieved of all symptoms, including the discharge. The deeper cauterizations done under anesthesia (any deep cauterization should be done under anesthesia, because there is enough parametrial reaction to necessitate rest in bed if you are to get good results from the cauterization), were followed in 65 per cent by relief of symptoms.

I was surprised to learn that the fourth form of treatment, operation upon the cervix, was used in only 25 of the very many cases studied. I was also a little bit disappointed that he did not refer particularly to the Sturmdorf procedure, which, we believe, is the procedure *par excellence* in the cure of the majority of these cases, in that it cures the leucorrhea, relieves symptoms, such as backache, and clears up the parametritis or uterosacral cellulitis that follows chronic cases. In a recent report of mine before the American Medical Association I showed that 70 per cent were cured and 22 per cent were markedly relieved. We furthermore proved that pregnancy and labor following this operation were not interfered with any more than in an ordinary trachelorrhaphy.

DR. G. G. WARD.—There has been an increase of interest among gynecologists as to the importance of diseases of the cervix. A symposium at the recent meeting of the American Medical Association was devoted to the subject, and it was well received.

We must appreciate the fact that from such an exhaustive analysis as this we are able to make deductions that are of real value. Instead of having opinions based upon tradition, these ideas are based upon an actual study of recorded facts.

The particular interest that I have in this subject is from the standpoint of its being an etiologic factor in cancer of the cervix. We realize that the statistics compiled by professional statisticians show that cancer is increasing progressively, and that a large percentage is uterine cancer.

While Dr. Fulkerson reported only one case of carcinoma in this large series, still he does not know how many cases which were treated might have developed carcinoma later if they had not been cured of their endocervicitis. I think the majority of authorities agree that the chronic irritation that exists in all these cases undoubtedly is a predisposing factor in the development of cancer.

Dr. Farrar and I have recently been studying some 300 cases of cancer at the Woman's Hospital, and in that series over 95 per cent have borne children or had abortions, thus showing that probably trauma of some type may have had an effect upon the cervix that might have predisposed to cancer.

We have a follow-up at the Woman's Hospital in the Obstetrical Division where the patients return for examination each month for three visits; they are checked up with a visual examination at their final visit. We believe that a great many erosions will be thus discovered and treated which would otherwise be ignored. There is a recent tendency among obstetricians to resort to immediate repair of a laceration of the cervix at the time of labor. We do an episiotomy and repair it immediately and we can place a stitch in the cervix with practically the same degree of safety if we do it under proper conditions, such as those found in the delivery room of a hospital. I believe if this is done that we will be able to prevent erosions of the cervix which cause these subsequent troubles. I think that this is something worth serious consideration, as possibly it will do away with a great many of the causes of erosion that may ultimately lead to cancer.

DR. W. P. HEALY.—It seems to me that cancer incidence is too important to be avoided in a paper of this kind, especially since the doctor emphasized the fact that endocervicitis was not a factor, in his series at any rate, in the possible production of cancer. That is contrary to the belief of those of us who are dealing with cancer.

Dr. Fulkerson did, however, bring out a point which I think is probably the important one, and that is that endocervicitis as he observed it from the age standpoint occurred in those who were rather young, the average in his series being about 33½ years, whereas cancer tends to occur a little bit later, the average age for cervical cancer being over 40.

The point I have in mind is this: We must endeavor to avoid the development of cancer, by teaching these women how to avoid it, or to do something that will prevent it, and I am firmly of the opinion that in the young woman in the child-bearing period of life when we still want to preserve the cervix for the purpose of pregnancy, that the very best treatment for those cervixes, and the safest for the patient, is the actual cautery.

I feel that silver nitrate is a good deal of an irritant and possibly does more damage than good on the whole, and irritation is bad.

On the other hand, I am also of the opinion that in the older woman who is forty years of age or older—practically, we might say, beyond the child-bearing period—that any disease in the cervix may be treated much more radically than with the cautery alone, because then you have a persistent organized lesion, whereas in the earlier years you have a rather subacute inflammatory lesion, and I feel at that time the best treatment is complete removal of the cervix, or at any rate, the removal of the diseased tissue.



DR. FULKERSON (closing).—In reply to Dr. Matthews, I was referring to the Sturmdorf operation when I spoke of the inadvisability of operative procedures in the treatment of endocervicitis because of the tendency to produce abortion and dystocia in labor. In the April, 1926, issue of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY there is a case report of rupture of the uterus following the Sturmdorf operation, and I believe other instances of dystocia have been reported.

Emmet's trachelorrhaphy is undoubtedly a desirable operation where inflammation does not exist or after it has been cured, if there is a condition that requires repair. The point I wish to emphasize particularly is that in this series of clinic cases 65 per cent of patients were cured by the cautery method; while a great many of the uncured cases were not followed up and probably could have been cured by second cauterizations. It seems that nearly all the cases could have been cured by the cautery method if they had been sufficiently followed up and recauterized.

Another point I wish to bring out is that mutilating operations of any kind on the cervix should only be done in a small percentage of cases, about the percentage that is shown in this series, perhaps 25 out of 1000 cases, and that that proportion of cases of cervicitis might require operative treatment to cure the condition.

In reference to Dr. Ward and Dr. Healy: there is no intention on my part to try to disprove the fact that chronic inflammation tends to produce cancer anywhere in the body. That is a generally accepted view. It is only that if cancer does follow endocervicitis, the endocervicitis exists so long before the cancer age that there is plenty of opportunity for the gynecologist to cure it by the cautery method before malignancy develops.

DR. JOSEPH HOFBAUER, of Baltimore, Md., (by invitation) presented a paper entitled **An Experimental Study of the Toxemias of Pregnancy**. (For original article see page 159, August issue.)

#### DISCUSSION

DR. G. W. KOSMAK.—It seems to me that the Society should consider itself honored to have Prof. Hofbauer come here and demonstrate to it in so interesting and conclusive a manner the experiments which he has recently carried out. The experiments demonstrate very well how the empiric treatment of these toxemias of pregnancy that we have followed in recent years is, or may be, proved by an experimental basis in fact.

One thing after another has been tried in the treatment of toxemias of pregnancy and abandoned as the clinical results have failed to come up to our expectations, but I think the points which Prof. Hofbauer has brought out tonight should lead us to continue further the conservative treatment which has become the vogue in recent years. We have followed these conservative methods in a way without really knowing why, but the clinical values which have resulted from their employment and the points that have been brought out should lead us to continue with this form of treatment rather than to go back to the more or less radical measures that we have employed in the past.

I believe that if Prof. Hofbauer's views hold (and I have no doubt that they will, and that other things will be brought out in the course of time to support them), then it will be a disgrace for any obstetrician to be compelled to terminate pregnancy either in the early months for hyperemesis or in the latter months for eclampsia, without having resorted to some of these proved facts.

An interesting point that Dr. Hofbauer made in the beginning of his paper and a point that should be circulated very much more widely than it has been, is the asso-

ciation of premature separation of the placenta with a toxic process. It is true, we have all admitted it more or less. In the recent years it has been attributed to various etiologic factors, including placental infarcts, but Dr. Hofbauer's slides have shown us very well just what takes place and he has also demonstrated by his confirmatory animal experiments what the basis of this possible placental separation is.

DR. HAROLD BAILEY.—Some of the slides presented I could substitute in my own teaching course, as they are almost indistinguishable from the specimens of the human liver in the toxemia of early pregnancy and of eclampsia.

It is interesting, in regard to our knowledge of histamine, that Dr. Abel first thought that it was the active principle of the posterior pituitary gland. It causes, I believe, a preliminary rise in blood pressure and later vasodilatation, and these two points could hardly be correlated until Prof. Hofbauer told us of the work of Dale, which shows that histamine stimulates the adrenals. In accidental hemorrhage we see very much the same thing; at the start, perhaps with only minute doses of the toxin escaping into the blood stream, there is a tremendous rise in blood pressure, sometimes as high as 240. I might mention the fact that there is seldom a year in which we do not have a patient of this type die on the table. They are particularly and peculiarly susceptible to shock which may occur after only a moderate operative procedure.

Two other substances produced in the upper part of the intestinal tract act in a like manner, namely, secretin and cholin. Attempts have been made to prove that secretin and histamine are one and the same.

As far back as twenty years ago, in the Pharmacological Department of Cornell, under Prof. Hatcher, the subject of cholin was brought up and discussed. We were especially interested because of a case of toxemia of early pregnancy. The charts all showed a very high rise in blood pressure following the cholin injections, and later fatal shock. It is possible that this was a vasodilatation produced by putrefaction in the intestinal tract.

DR. HOFBAUER (closing).—I agree in every way with the remarks made by Dr. Kosmak.

With regard to Dr. Bailey's statements, it must be borne in mind that the blood supply of the brain is mainly controlled by the splanchnic system through the vasomotor centers in the medulla and the midbrain, which react to the slightest degree of anemia. Consequently, it is quite likely that a certain distention of the vessels in the splanchnic area might give rise to shock-like conditions. As regards the presence of cholin in the blood, there is one point to which I wish to call your attention. About four years ago, I had the opportunity of working in Doederlein's clinic in Munich, where I introduced a supplement to the local radium treatment of cancer of the uterus, namely, the application of a stimulating dose of x-rays to the region of the hypophysis preceding the local cervical treatment. Apart from a definite increase in the number of eosinophiles and red blood cells a higher titer of the cholin content of the blood could be demonstrated by biologic tests after the radiation of the hypophysis. These observations illustrated that some connection must exist between the activities of certain ductless glands and the constituents of the blood, which are known to play a significant part as factors in producing a power of resistance to disease, particularly the infections and carcinoma. On more than one occasion Doederlein emphasized the point that the new method of treatment may account for the improved general condition of the patients, as well as a considerably higher percentage of cures.

## BROOKLYN GYNECOLOGICAL SOCIETY

STATED MEETING, DECEMBER 4, 1925

DR. WM. C. MEAGHER reported a case of **Chorioepithelioma with Pulmonary Metastases.**

L. L., female, aged twenty-two years, married, admitted to Greenpoint Hospital, May 20, 1925, complaining of pain in both lower quadrants, foul discharge from vagina, and headache. In the early part of November, 1923, she was curetted at home for a hydatidiform mole. One week later she was admitted to Kings County Hospital, where, on November 19, 1923, a salpingo-oophorectomy and appendectomy were performed. For four months patient felt very well and then began to complain of headache, which came on suddenly, was constant and dull aching in character, and persisted up to admission to hospital. Coincident with the onset of the headache, was the beginning of the sharp pain in both lower abdominal quadrants, which was aggravated upon walking. In August, 1924, patient began to bleed profusely, but gradually the amount diminished until there was but a daily spotting and passage of small clots, which in turn were replaced by a gray, foul-smelling discharge, the latter having been in evidence for one month, at the time of admission.

Patient has had chronic cough for five years, had night sweats once, ten days before, hemoptysis once, one and one-half months before, and has lost twenty pounds in the past two months.

Menstrual history normal. No change in habit or type until one year previously. First child three years before. Second, a premature, living four days, two years before. Both spontaneous deliveries and no postpartum complications. No miscarriages. Frequent micturition at night.

Physical examination, May 21, 1925, disclosed a fairly well-nourished female. *Chest*, slight dullness over the left upper lobe posteriorly. *Abdomen*, slight umbilical hernia, midrectus scar below umbilicus with small hernia presenting through the scar. Slightly rigid in both lower quadrants. An irregular mass is felt below the umbilicus extending to the symphysis and about two inches on either side of the midline. This mass is tender and indurated and seems to be attached to parietal peritoneum anteriorly. *Vagina*, introitus parous, dirty gray, malodorous discharge; old laceration of a soft cervix that presents an external os sufficiently patent to admit the tip of one finger. The fundus is about the size of a twelve weeks' pregnancy, fixed, and very tender. Tentative diagnosis, chronic degenerative fibroid uterus.

On June 15, examination of the chest revealed many moist râles over entire right lower lobe, scattered areas of moist and crepitant râles over right middle and upper lobes, and marked pleural friction rub in the infraclavicular space on the right side. Sonorous, sibilant, and crepitant râles were heard over the lower left lobe.

The temperature was normal on admission, reached 102° during the course of the disease and was 97° before death; pulse rate ranged from 84 to 160; respirations were 20 to 60.

Urinalysis varied, showing at times a faint to a heavy trace of albumin; occasional pus cells to many; once red blood cells, and once granular casts. The frequent blood counts showed a progressive increase of white blood cells and polys from

10,200 to 22,400, of the former and 73 per cent to 84 per cent of the latter. The hemoglobin on Tallqvist estimation showed a gradual decrease from 65 per cent to 40 per cent. The red cells ranged from 3,744,000 in the first count to 2,480,000 in the last. The blood culture was sterile on two occasions. The Wassermann was negative. Blood urea, 25.2 mg.; creatinine, 1.9 mg. The sputum and stool were both negative for tubercle bacillus.

X-rays of the chest revealed the following: May 22, apices clear, lung fields show no definite infiltration or opacity; June 17, lung fields show considerable amount of infiltration, suggesting tuberculosis. Other clinical data must be considered before diagnosis of tuberculosis is made.

The patient died July 7, 1925, after forty-nine days in the hospital.

The uterus was extensively traumatized upon removal. It is symmetrical and measures 12x15x12 cm. The serous coat over the fundal and anterior wall shows dense adhesions of omentum. Scattered throughout, but especially marked on the posterior wall, are gray-white and brownish zones, round or oval, varying from 3 to 10 mm. in size. The anterior wall and the fundus are firm; the posterior wall is soft. The uterine cavity was filled with gray-white and tubercous masses which are friable, opaque and necrotic. Upon incision these masses extend irregularly through the uterine wall as discrete ovoid nodules ranging from 2 to 10 mm. Many of these have reached the serous coat. The anterior wall is most extensively involved and presents as an opaque, solid mass filled with tumor tissue. In this region the wall measures 6.5 cm. In other regions the wall measures 2 to 2½ cm. in circumference.

Microscopically, sections from the compact zone of the anterior wall show complete necrosis. All vestiges of muscle have disappeared and structure of the organ is lost save for several thrombosed vessels. Necrotic debris, blood, fibrin, and karyorrhetic particles are present. Scattered through the periphery of the necrotic mass are islands of degenerating tumor cells. Many of them are recognizable as Langhans' cells occurring in thin sheets of 4 to 6 cell layers. Syncytial cells are not positively identified.

Through the less affected zones of the uterus with the discrete nodules grossly noted, the findings are essentially as above. Blood, fibrin, and necrotic debris comprise the bulk of the tumor. Scattered through are degenerating and necrotic tumor cells. At the periphery they are better preserved. In the lumen a peripheral vein detached lumps of Langhans' cells are present. The outer third of the uterine wall is well preserved, likewise the fasciculi of muscle and connective tissue. Section from the cervix shows normal cervical glands and injected vessels. The metastatic focus lies deep in the muscle zone. Its features are the same as those in the body.

*Diagnosis.*—Chorioepithelioma of uterus.

Tube markedly thickened and indurated, measured 16 cm. in length. In its outer third it fuses insensibly with a parovarian cyst, so that only the abdominal ostium and fimbriae remain. The latter are markedly thickened and indurated. On section the tube lumen is narrow and mucous folds are normal. The muscle coat is markedly thickened and shows several injected vessels. The parovarian cyst is ovoid and measures 10x7½ cm. It is lined by injected and thrombotic epithelium. Its wall is fibrous and hemorrhagic.

Ovary enlarged and irregular and measured 5x4.5x2.5 cm. Its medial aspect presents an ovoid cyst projecting from the free border and measuring 2.5 cm. Consistency is firm and color is gray-white. On section, cortex presents follicular cysts, the largest of which has been grossly noted. The medulla is dense, firm, and sclerotic. At the hilum of the ovary lies an almond-shaped, hemorrhagic metastasis measuring 25x10 mm.

Microscopically the tube lumen and its mucous folds are normal. The muscle layer shows marked edema and in foci is mucoid. The hemorrhagic areas noted on gross appearance are the result of interstitial bleeding. Congestion of all vessels is prominent.

The parovarium has lost its lining epithelium. Its walls are comprised of fibrous tissue and muscle fasciuli markedly separated by edema and interstitial bleeding accounting for the injected mucosa on gross examination.

The ovary presents advanced sclerosis of tunica with cortex only moderately involved. All cysts are of the granular type. Primordial follicles are scant. Medulla is thickened and filled compactly with large and small sclerotic veins. No evidences of theca interna cysts are present. Capillaries are prominent.

Lungs are both normal in form. The surface is studied with firm, reddish-white nodules, measuring 10x24 mm. in size. On section they present either clusters or discrete nodules invading or replacing pulmonary alveoli. The adjacent lung tissue shows congestion and compression. Involvement is diffuse and rather uniform throughout.

Microscopically the nodules are necrotic and all traces of lung or tumor have disappeared. Blood and fibrin are encountered. At the periphery of the nodule clusters of pale cells with vesicular nuclei are interpreted as Langhans' cells. Syncytial cells are not defined. The adjacent pulmonary tissue shows atelectasis.

*Diagnosis.*—Chorioepithelioma of lung.

#### DISCUSSION

DR. O. A. GORDON, JR.—Chorioepithelioma is in some places considered a comparatively common condition, but this is decidedly not true. It is considered so because of the great difficulty in diagnosing the condition histologically. The absolute rarity of this condition may be estimated from the fact that Dr. Symmers at Bellevue Hospital has done something over 5,000 autopsies on women during his time there, and has discovered but two cases of chorioepithelioma, one a doubtful case with vaginal metastasis, and the other an authentic case.

Undoubtedly if chorioepithelioma was as common as it is sometimes reported, death would be a fairly common occurrence, because it is a very malignant neoplasm. The confusion arises from the fact that chorionic villus has no definite location. Even in normal cases it sometimes circulates freely in the blood stream and possibly lodges in the lung and is destroyed there by the lytic action of the blood. Therefore, many cases are reported as chorioepithelioma that are not so in fact.

As to the histologic diagnosis of this tumor; if the tumor is limited to the uterus, the best authorities maintain that histologic diagnosis alone is not sufficient; that its resemblance to the normal chorionic villus is so close that the diagnosis cannot be made absolutely on the histologic findings.

A word as to the treatment of this condition, which Dr. Mcagher did not consider in the report of his case. Many cases are subjected to unnecessary hysterectomy following hydatidiform mole in which there is a suspicion of chorioepithelioma.

In 1917 Dr. Vineberg emphasized that vaginal hysterectomy was a good procedure in suspected cases. It has also been emphasized in suspected cases that abdominal hysterectomy should be done as a final procedure before hysterectomy, and of late it has been pointed out (and it seems to me it is a most rational form of treatment) that radioactive substances should be of great value in suspected cases of chorioepithelioma, because the tumor is composed entirely of embryonal tissue which succumbs readily to radioactive substances, especially the x-ray.

DR. C. A. GORDON.—I believe that radio activity applied to this tumor in the uterus would not be good. Although it is true that radium has a specific action on embryonal tissue, it also, as I understand it, has a specific action on endothelium and blood vessels, and although the tumor itself is making rapid progress in the blood vessels, radium in the uterus may still further break down the blood vessels and speed the tumor on its way.

I agree with Dr. Gordon that histologic examination of tissue from the uterus is absolutely of no value in diagnosis.

An interesting thing is that no metastasis was reported in the vagina, which is as a rule the first place the tumor will show metastatic growth.

In regard to operation for tumor of this sort; although Dr. Gordon calls attention to its great malignancy, and this is largely true, I am sure figures will show that a tumor is of varying malignancy, and a great many cases have been reported of cure after operation, and cases have been reported where apparently miracles have been performed, where the growth in the uterus disappeared after operation on metastasis, and where operation was abandoned during its course because it was felt it was futile.

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## AMERICAN MEDICAL ASSOCIATION

*SEVENTY-SEVENTH ANNUAL SESSION, DALLAS, TEXAS, APRIL 19 TO 23,  
1926*

DR. GEORGE GRAY WARD in his Chairman's Address pointed out that the union of obstetrics and gynecology is essential if we are to expect better obstetric research, as the physiology and pathology of the reproductive system of women must be considered as a whole if we are to solve successfully the problems which are so interwoven with both sciences. The intimate relation between obstetrics and gynecology which exists in European clinics has, unfortunately for both branches of the specialty, not found universal application in this country. Gynecology in its beginning was largely reparative, and therefore surgical, and its tendency was to develop independently for this reason. But in recent years there has been an awakening to an appreciation of the broader gynecology, which comprises all phases of the reproductive function and of which surgical therapy is but a part.

In preventive obstetric measures lie the means of avoiding many gynecologic lesions. If the general practitioner will but do his full duty towards his obstetric patients, more than half of the work that is now done by the gynecologist will not be necessary. This will require the earnest attention of the obstetrician not only during the labor but also in the antenatal and postnatal periods.

The gynecology of today has undergone a great, expansive change from the gynecology of yesterday, which was largely confined to the narrow field of operative technic. This broader development which has taken place is largely the result of the application of the fundamental principles of physics and chemistry in the study of life processes, and through the sciences of biology, biochemistry and genetics a better appreciation of the intimate relations existing between the reproductive organs and the body as a whole has been brought about.

The entire program of the first day was devoted to **Cervical Disease.**

**DR. CAREY CULBERTSON** of Chicago read a paper on **Erosions of the Cervix Uteri.**

He pointed out that leucorrhea is apparently a precursor in the development of erosion, causing the maceration and disintegration of the squamous epithelium of the portio. Then follows the appearance of glands, cervical in type, the papillary form of erosion. Attempt at spontaneous healing is represented by the reappearance of layers of flat epithelial cells, over the glandular structure and proliferation of these cells into the dilated gland lumina. The so-called follicular erosion resembles a cervical mucous polyp which has prolapsed into the vagina and taken on, again, a covering of flat epithelium and such a development has a relation to further epithelial proliferation and malignancy.

**DR. C. JEFF MILLER** of New Orleans discussed **Chronic Endocervicitis.**

He pointed out that endocervicitis is a definite clinical entity of such common incidence and such grave potentialities that many writers do not hesitate to affirm that it causes more loss of time and more inconvenience to those affected with it than does any other gynecologic condition. He believes that there is no gynecologic affection which is the subject of more misdirected and more unsatisfactory treatment. The obvious cause for most of our poor results is that past treatment has been directed along irrational and illogical lines in that it was directed toward manifestations of the disease rather than its underlying pathology.

The etiology of chronic endocervicitis is still far from clear. Many of the cases are undoubtedly due to specific infection, some from direct contact, some from a childhood infection which was possibly so mild that it passed unnoticed. The normal external os has to some extent the faculty of the internal os of prohibiting the entrance of pathogenic bacteria, but when injuries occur, such as lacerations from childbirth, or, less frequently, from careless instrumentation, this is no longer the case, and the gaping, open os and exposed mucosa offer an easy avenue of access for whatever bacteria may be present.

Practically all types of bacteria may be identified in chronic endocervicitis, but certain types are predominant. The gonococcus, the streptococcus, the staphylococcus and the colon bacillus are believed to occur in order of frequency, while mixed infections are not uncommon.

The pelvic manifestations are more usually in the ovaries than in the tubes and parametritis is frequent, particularly in association with posterior cellulitis.

The symptomatology of the disease is various and is often complicated by the fact that when the patient reaches us we are dealing not only with endocervicitis but with associated or resulting pathology which may entirely overshadow the original lesion. The most constant symptom is a leucorrheal discharge, but menstrual derangements are not uncommon. Backache and dyspareunia are not ordinarily present unless there are associated displacements or parametrial involvement, particularly posterior cellulitis, with extension to the uterosacral ligaments. Sterility is a frequent complication, owing to the plugging of the cervical canal by tenacious mucus or by the thick cervical mucosa, or by the destruction of the spermatozoa by purulent secretions. Constipation is frequent, and systemic manifestations will vary according to the severity of the disease.

The structural peculiarities of the cervix, its frequent exposure to trauma and infection, and its faculty of harboring bacteria over long periods of time, all emphasize the fact that local, superficial treatment is worse than useless, and that any methods which are to succeed must be directed towards the underlying pathology of the deeper cervical structures.

**DR. HARVEY B. MATTHEWS** of Brooklyn discussed **The Sturmdorf Operation vs. the Cautery in the Treatment of Chronic Endocervicitis.**

In comparing the results of the cautery treatment with the Sturmdorf enucleation operation for the cure of chronic endocervicitis it seems fair to state that cauterization is, for the majority of cases, an office procedure, whereas the Sturmdorf operation requires hospitalization or its equivalent with an anesthesia—local, regional or general.

Cauterization is primarily a prophylactic measure that, if properly employed early in the course of chronic endocervicitis, will obviate the necessity of operation later when the infection becomes more widely and deeply disseminated.

Cauterization is more successful in those cases where the infection is superficial and the lacerations are not extensive. There is a type of hyperplastic cystic endocervicitis encountered during the childbearing age (infection of long standing) in which cauterization is contraindicated because of the resulting scar formation with possible stricture or stenosis of the cervical canal. The Sturmdorf operation will remove the infected cervical mucosa with its glands and is, therefore, preferable.

Cauterization is most successful in destroying the infected cervical mucosa after the menopause or preceding supracervical hysterectomy where further menstruation is impossible.

The Sturmdorf operation is primarily indicated in those cases not suitable for cauterization, i. e., infection of long standing, deeply disseminated with cystic changes, encountered during menstrual life.

Pregnancy and labor are not interfered with in any way by the superficial and moderately deep cauterization of the cervix. The deep and more extensive cauterizations under anesthesia, naturally, are more apt to cause complications during pregnancy and labor, although 6 cases of 55 cauterized under anesthesia had perfectly normal labors.

Pregnancy and labor, after the Sturmdorf operation, are not any more interfered with than by trachelorrhaphy. Out of a total of 28 pregnancies after the Sturmdorf "cone" operation, there were 17 normal labors, 3 had moderate cervical dystocia but delivered normally, 1 had low forceps, 1 had cesarean section, the indication for which was not the cervix, 6 cases aborted (cause not found in the cervix).

**DRS. BUDD C. CORBUS** and **VINCENT J. O'CONOR** of Chicago presented a paper on **Diathermy in the Treatment of Gonorrheal Endocervicitis.**

To obtain success in the treatment of gonorrheal endocervicitis through the use of diathermy, one must maintain a clear perspective of the object sought for, i. e., destruction in situ of the thriving gonococcal organisms which are imbedded in and protected by the tissues of the cervix. At the same time, the destructive agent should not produce or cause any permanent injury to the endocervical canal.

Gonococci frequently disappear permanently from the urethra during respiratory infections, and the same thing has been noted during the pyrexia of typhoid. It has been demonstrated that the gonococcus is instantly destroyed at a temperature of 113° F. (45° C.), or at 104° F. (40° C.), prolonged for six to eight hours.

Since the normally nourished epithelial cell can survive a temperature of 118° F. (47.8° C.), for one hour, and connective tissue cells even higher temperatures for longer periods, the rationale of the therapeutic possibilities for destroying the gonococcus within the living tissue by heat is manifest.

Endocervical diathermy is contraindicated, however, during pregnancy and in the



early acute stages of infection or when active pelvic inflammatory changes, such as salpingitis or pelvic cellulitis, are present.

The authors use the cervical electrode for periods of thirty to forty minutes at a temperature of 116° to 117° F. (46.5°-47° C.), but occasionally continue the treatment for sixty minutes or longer with a varied reduction in temperature.

They pointed out that in order to be successful in the cure of gonorrheal endocervicitis, infection in the urethra, Bartholin's and Skene's glands must also be eliminated.

Treatments must be continued until it is definitely proved that the gonococcus is permanently eliminated from the tissues.

The clinical results obtained by the careful application of this method have been demonstrated to their complete satisfaction in the management of approximately 150 patients during a period of more than six years.

### DR. GEORGE GELLHORN of St. Louis discussed Syphilis of the Cervix.

Ten years ago syphilitic lesions of the cervix were considered so extremely rare as to be without any practical importance, but it is now recognized that the cervix may be the seat of syphilitic manifestations in every stage of the disease.

The hard chancre of the cervix is usually located upon the anterior lip. If engrafted on a preexisting erosion, it may more or less completely surround the external os, but even then the anterior lip is definitely more involved than the rest. While the primary lesion on the outer genitals presents and retains its characteristic and pathognostic aspect, the chancre of the cervix undergoes a rapid and variegated evolution from an uneroded induration to an ulcer which in turn either heals quickly or transforms into an inconspicuous erosion. In the stage of greatest development, it appears as a more or less deep, funnel-shaped sore with thickened, rounded edges which slope down to a smooth floor of a glistening, brown color. A greyish or white pseudomembrane, composed of necrotic tissue, and, therefore, firmly attached, covers the base of the ulceration, and a thin red or reddish-brown line encircles its periphery. There is usually very little, if any bleeding, even on manipulation. Multiple chancres are not exceptional.

There is no inflammatory reaction in the surrounding tissues; yet the entire cervix is often larger and harder from a general indurating edema and, when exposed in a speculum, fairly jumps into view. On account of this general infiltration the typical parchment-like induration of the base cannot be mapped out, except in pregnancy when the cervical tissues are softened, or in prolapsed uteri where palpation is more easily accomplished.

The histologic picture is that of any chronic inflammation and is itself by no means pathognostic unless one succeeds in demonstrating the *Spirochete pallida* in the tissues.

The cervical sclerosis has no particular symptomatology. For this reason, the discovery of a primary lesion on the cervix is largely accidental, and it is probable that most cervical chancres are entirely overlooked.

The Wassermann reaction does not become positive until two or three weeks after the establishment of the chancre. Spirochetes, however, can easily be found in the scant secretion of the sore.

In the secondary stage syphilis manifests itself upon the cervix in the form of macules, papules, and ulcers. These forms represent three successive stages in the development of lesions caused by scattered accumulations of the *Spirochete pallida* in the squamous mucosa of the cervix. They usually are multiple and associated with similar lesions in various parts of the vagina and the outer genitals.

The essential tertiary lesion is that of a gumma. The histologic picture is essentially the same as in primary or secondary lesions. The process may involve the vagina or extend into the cervical canal, and is frequently associated with similar lesions elsewhere. The consistency is firm but becomes soft under the influence of tissue necrosis. The most characteristic color is yellow, though various other shades may be observed. Bleeding or profuse mucopurulent discharge is present; but pain is usually absent. The lesions may heal spontaneously with formation of scar tissue, but more often specific treatment is required. Local treatment is altogether useless.

**DR. GRANT E. WARD of Baltimore discussed Radium in the Treatment of Cancer of the Cervix Uteri as Now Used in the Howard A. Kelly Hospital.**

He compared the later statistics with those of former years.

Improved methods in technic have increased the percentage of cures in all groups, with the exception of the borderline. These were regarded as inoperable. Classifying the operable cases treated with radium alone, those treated with radium plus operation, and those treated prophylactically after operation as all operable, they have a total of 24, of which 14 were well when last seen. This gives a total clinical cure in the operable class, using operation and radium, of 58 per cent, against 57 per cent in those treated with radium alone. As stated above, many of the cases in this series are below the five-year period, but he feels that they warrant these conclusions when compared to our former statistics. In a further communication it is hoped that all cases treated in the Howard A. Kelly Hospital prior to five years ago, will be reviewed and the absolute five-year cure noted. In this last series of 141 inoperable cases, there resulted 43.2 per cent improvement; 28.3 per cent healing of the primary growth; and 11.2 per cent clinically cured. A clinical cure has been realized in 47 (20.2 per cent) of the 232 cases treated, including all classes of patients—operable, operated after radium, recurrent after operation, prophylactic after operation, borderline, radium and cautery, and inoperable. Of those treated by radium alone, i. e., the operable (not operated), borderline, and inoperable, 28 out of 174 or 16 per cent are clinically cured.

**DR. F. W. LYNCH of San Francisco reported his Five-Year End-Results as of March, 1926, in 107 Cervical Cancers Treated with Radium or by Operation between March, 1916, and March, 1921.**

Three cases only were lost from the follow up and only after three years' observation. His own observations and a critical study of the literature convinces him that three years' freedom from recurrence is not a proper definition for a permanent cure. He has twice as many three-year as five-year cures. His review of the literature shows that there were only 2 per cent to 5 per cent of recurrence after five years in the large series treated by the modern radical operation in spite of the fact that these series contained almost 50 per cent of borderline cases. The reported results of operable and borderline cases treated with radium closely parallel those of Bumm, who found one-third less cures after radium than operation when followed for six years, and more cures by radium than surgery when the same cases were followed for only three years.

Lynch finds that the best results with radium are in the inoperable cases which in the past were abandoned to die. Even in the seemingly hopeless cases, there are 3 per cent to 10 per cent of five-year cures. Lynch reports his radium results in 59 inoperable and borderline cases upon whom no operation had been performed for cancer. One inoperable case only was lost to view when well three and one-half

years after treatment. Two patients died from intercurrent disease without evidence of cancer at two and one-half and three years after treatment. Six died from cancer three to five years after treatment, while five, or 9 per cent, are well five to seven years after treatment. In contrast with these he finds in the literature up to present time only 306 operable cases radiated only and with only 40 per cent of cures. Since radium cures so many apparently hopeless cases and so few operable cases, it does not seem as if radium would solve the treatment of operable cases and that it is more than likely that vital forces in the body have much to do with the cure. Future improvements must be along biologic lines.

His study shows that the ordinary panhysterectomy is absolutely contraindicated.

He reports 23 cases upon whom competent surgeons had performed panhysterectomies and for whom he gave radium as prophylaxis or for early recurrence. Every case was dead from cancer within four years. Two cases radiated after cervical resection had shown cancer are still living five years after operation.

On the contrary, he collected from the literature 2,103 cases treated by modern radical operation with operative mortality of 16.7 per cent. In spite of the fact that this group represents 50 per cent to 60 per cent of all the cervical cancers applying for treatment while the series was developing, there were 42.1 per cent cures. He believes that since the results of surgery for operable and borderline cases actually exceed those of radium alone that more cancers can be cured if operable cases are operated after radium and all others are treated with radium alone, after developing body defences by blood transfusions and general systemic measures. Weibel shows five-year cures by surgery in 87 per cent of the early operable cases and in 53 per cent of the other operable cases. This should be contrasted with the radium cures of only 40 per cent. Lynch has operated 36 cases radically with four deaths. Seventeen come in the five-year period. There were three operative deaths. Two cases were lost when well after three and one-half years. Eight cases are well five and one-half to ten years after operation. He also operated an inoperable case which had been made operable by radium. This patient is still alive seven and one-half years after operation. He is uncertain as to which therapeutic measure deserves the credit. On the contrary, he has radiated five operable cases, one of which died from heart disease and three from cancer between three and four years. One only survived.

There were 27 per cent of cures by all methods for three years and 16.8 per cent for five years.

**DRS. R. L. DICKINSON, New York, and WILLIAM H. CARY, Brooklyn, presented an Analysis of the Cures and Failures in the Treatment of Sterility.**

Several thousand clinical histories of sterile unions, recorded by living expert students of the subject, are available for combined systematic analysis—particularly of the items absent in publications, such as charted correlation of causes, and reasons for success or failure. Certain essential researches on human semen, insemination and ovulation are defined, and their study is begun. In both matters organized work is called for.

Any tubal testing, treatment, or operative procedure for sterility that is done on a wife, before the present condition of the husband is determined, should, in these days, carry the stigma of malpractice.

Semen defects appear to account for one-third of sterile marriages, one-fourth of these defects offering hope of betterment. Adding his contribution of venereal infection may bring the husband's responsibility up to one-half, and charges up to him the least curable of the wife's sterilities, tubes sealed by inflammation.

With the present tests of tubal patency, and the hoped for determination of the day of ovulation, artificial impregnation may come up to the large claims made for it.

Curability of the woman in the opinion of representative gynecologists ranges from one chance in seven with closed tubes, to one in three in more favorable conditions. With careful selection, and by persistence in treatment it is shown that even better results may be obtained. Thus we may be able, after eliminating the grossly incurable, to relieve eventually one-half of the sterile unions.

### DR. DONALD MACOMBER, Boston, discussed **Low Calcium as a Cause of Intrauterine Mortality.**

He pointed out that diets low in calcium do not produce sterility in the adult rat but affect the fertility by increasing the intrauterine mortality.

In the rat pregnancy makes relatively small demand on the mothers because the young are largely cartilaginous at birth. Even where the diet is very low in calcium the fetus is normal at birth both in weight and calcium content. To a certain extent it acts as a parasite upon the maternal organism and draws its calcium from her reserve. This is shown by analysis of the maternal calcium, by x-rays of the bones and by the specific decalcification of the teeth.

In the rat all these effects are intensified by lactation. The mother rapidly loses calcium from her body to supply the needs of the growing young; but the young are now not able to get all they need and soon show signs of a lack of calcium by stunting, weakness, and often death. This is to be contrasted with the fetal ability to live at the expense of the mother. The difference is probably not however due to a physiologically different principle, but to the much greater needs of the growing young and the increasing resistance of the maternal organism to sacrifice its reserves. That this is perhaps so is shown by the fact that low calcium causes the death of the fetus even late in pregnancy with the cow.

Lastly there is, it seems, a real lesson to be drawn from this study in regard to the dietetic management of pregnancy and lactation. There must be an adequate source of calcium in the diet of the pregnant and the nursing woman if these functions are to be carried out normally and with a minimum of such disturbances as caries, stillbirths and failures of lactation.

### DR. HAROLD A. MILLER, Pittsburgh, reported the **Postpuerperal Morbidity in a Series of One Thousand Cases**, from which the following conclusions are available.

First: postpuerperal morbidity occurs much more frequently than is generally supposed. If evenly divided every postpuerperal woman would be a sufferer in at least one particular.

Second: a fully dilated cervix is one which is retracted over the fetal head and not one which is spoken of as dilatable.

Third: operative deliveries of any character seem to increase the postpuerperal morbidity and are to be condemned even though we entirely disregard the immediate danger of infection, except where absolutely necessary to preserve the life of mother or child.

Fourth: temperatures during the puerperal period, even though slight, leave in their wake some definite evidence of damage having been done.

Fifth: the now existing postpuerperal morbidity would seem to justify a return to the rational noninterference in the normal woman and the avoidance of all fetal distress, uterine inertia, or disproportion.

Sixth: attention to cervical injuries will markedly lessen the discomfort of the patient and in cases of erosion may have an influence on decreasing malignancy.

Seventh: make postpuerperal examinations after each delivery.

**DRS. W. C. DANFORTH and C. E. GALLOWAY, Evanston, discussed Retro-displacements of the Uterus During Pregnancy and the Puerperium.**

About one woman in five in a series of private patients had retrodisplacement during pregnancy and the puerperium. Retrodisplacement during pregnancy, provided an intelligent vigilance is exercised, need cause but little trouble. Twenty-nine per cent of those seen by the authors were replaced and subsequently supported by a pessary. The remainder corrected spontaneously. Fourteen and four-tenths per cent showed a backward position at eight weeks postpartum. Replacing the uterus and supporting it by a pessary at this time aids the process of involution but does not invariably cure the displacement permanently.

**DR. CARL HENRY DAVIS of Milwaukee discussed the problems pertaining to the Thyroid in Pregnancy, giving data on the basal metabolic rate and the blood calcium.**

He pointed out that approximately 41 per cent of the last 520 women examined in early pregnancy had visible hypertrophy of the thyroid. Eight of these patients have returned with typical symptoms of toxic goiter within fourteen months after delivery. Small doses of iodine have been administered during pregnancy but none after delivery. No patient has returned with hyperthyroidism earlier than four months after delivery. Overwork, worry and other nervous strain appear as contributing causes in each case.

The use of iodine during pregnancy by women who live in goiter districts is advocated unless they have adenoma of the thyroid. Iodine hyperthyroidism is recognized as a possibility but thus far has not been observed. The average metabolic rate of nine women with normal thyroids at term was +2.4 per cent. Their average after delivery was -1.3 per cent. The average rate of seven women with simple hypertrophy was +22.1 per cent before term with a later drop to +3.1 per cent. The average rate of nine women believed to be of the hyperthyroid type was +32.2 per cent before delivery and a drop eleven days postpartum to +8.9 per cent. With the exception of two in the last group, these patients took small doses of iodine during the last months of pregnancy. Patients previously operated upon for toxic goiter are usually benefited by taking small doses of iodine during pregnancy. One such patient in the small group under observation apparently could not tolerate iodine.

One patient had a successful operation for adenoma of the thyroid in the fourth month of pregnancy and later took iodine. One patient with a history of toxic adenoma took iodine during pregnancy with apparent benefit although she had a metabolic rate of +86 at term. She was successfully operated upon twenty days postpartum. The baby was continued at breast and complementary feedings were stopped six days after the operation. The subsequent history of both mother and infant is very satisfactory. Prolonged nausea and vomiting in one case was evidently due to a crisis of exophthalmic goiter. The metabolic rates on this patient are given. She had a rate of +81 per cent ten days before delivery. Her nausea was lessened by the use of iodine.

Patients with toxemia of pregnancy had low readings. Three with edema and little or no albumin had lower readings than the single patient with high blood pressure, albumin and casts but no edema.

Comparative studies of the blood calcium and thyroid function as indicated by the basal metabolic rate show no relation between the milligrams of calcium in each 100 c.c. of serum and the metabolic rate. The calcium determinations in twenty-four women with uncomplicated pregnancy showed an average of 9.97 mg. before delivery and 10.5 eleven days postpartum. Most of these women had taken calcium salts in addition to their food. The average for the individuals with thyroid hypertrophy was slightly higher than the average for the women with normal thyroids, but a small series does not warrant conclusions. Three patients with toxemia of pregnancy showed a lowering of the calcium postpartum while the normal patients usually showed an apparent increase within eleven days. The use of cod-liver oil and ultraviolet light did not appear to increase the blood calcium in the few cases studied.

The observations made thus far suggest that if a woman with a normal thyroid has sufficient iodine during the course of a normal pregnancy her basal metabolic rate will remain within normal limits although it may show a slight increase toward the end of pregnancy. Metabolic rates which are well above normal limits are believed to indicate abnormal function of the thyroid, usually of slight degree. The return to normal limits within eleven days postpartum, while the rule, does not prove that the increased rate did not signify an abnormal function. These patients should be kept under medical observation for a long time after delivery. Many of the so-called neurotics of the past probably had disturbed thyroid function.

**DRS. ROBT. MUSSEY, WM. A. PLUMMER, and WALTER BOOTHBY of the Mayo Clinic discussed Pregnancy Complicating Exophthalmic Goiter and Adenomatous Goiter with Hyperthyroidism.**

A study was made of all pregnant women whose pregnancy was complicated by these diseases and who were examined at the Mayo Clinic during the ten-year period from Jan. 1, 1916, to Jan. 1, 1926. Out of this group of 5,043 women examined and operated upon for exophthalmic goiter during this period only 32 were pregnant. Since approximately 70 per cent of patients having adenomatous goiter with hyperthyroidism are more than forty years old, while about the same percentage of patients with exophthalmic goiter are less than forty years old, the proportion of women pregnant while having the latter disease is slightly greater than that of the former.

Of the 7,228 women in the two groups only 42 (0.6 per cent) were pregnant. This rare coincidence confirms Markoe's statement, made in 1918, that of approximately 100,000 pregnant women at the New York Lying-In Hospital only 8 appeared to be suffering from hyperthyroidism. This data can further be contrasted with that given in a report from the Mayo Clinic by Mussey in which 1.9 per cent of women operated upon for appendicitis and 1.7 per cent of those operated upon for disease of the gall bladder were pregnant.

In the cases of this series there is no evidence that pregnancy influenced the course of exophthalmic goiter. In only two of the 32 cases could the onset of the disease be considered with reasonable certainty to have developed during pregnancy. Of the 32 patients with exophthalmic goiter, 23 were delivered at term, 2 aborted, 2 were delivered prematurely, 2 are now pregnant, and three have not been traced.

In considering the methods of treatment used for the relief of exophthalmic goiter in cases of pregnancy the patients are divided into two groups: those treated before the introduction of iodine as a therapeutic aid in the control of exophthalmic goiter (20 patients) and those treated after this period (12 patients), which dates from the spring of 1923. Eighteen of the first group received some form of operative

treatment. In the second group the use of iodine obviated the necessity of any preliminary ligations. Thyroidectomy was performed on 7 after their symptoms had improved under treatment with Lugol's solution, and three were carried through pregnancy on Lugol's solution without operative interference. Two patients receiving Lugol's solution are now under observation.

All of the 10 patients having adenomatous goiter with hyperthyroidism became pregnant after the onset of the hyperthyroidism. All but one of the mothers had some form of operative treatment. One of them died, and 9 were delivered of normal, living babies.

The authors find that the course of pregnancy and the maternal and fetal mortality were not appreciably affected as a result of the syndrome due to exophthalmic goiter or to adenomatous goiter with hyperthyroidism nor, on the other hand, did the pregnancy render the control of these two diseases noticeably more difficult.

#### DR. J. EARLE ELSE of Portland presented a comprehensive paper on **Tuberculosis of the Ileum.**

With this condition there is a symptom complex consisting of irregular, mildly cramplike pains persisting over a considerable length of time accompanied by tenderness somewhat diffused and most marked in the lower right quadrant, anorexia, low fever, malaise, relieved by fasting but recurring as soon as the patient begins to eat again, nervousness and some abdominal distention in a patient having either pulmonary tuberculosis or a history of such. The finding of blood and pus in the stool increases the probability. A differential diagnosis between tuberculosis of the cecum and tuberculosis of the ileum alone is difficult to make. The differential diagnosis between ileac tuberculosis and acute appendicitis depends upon the chronicity of the former and the acuteness of the latter.

The author reviewed the results of operative treatment and urged the subsequent use of heliotherapy and iodine. The general hygienic measures used in the treatment of tuberculosis should be followed.

#### DRS. J. P. PRATT, Detroit, and EDGAR ALLEN, Columbia, Mo., discussed **Clinical Tests of the Ovarian Follicular Hormone.**

The estrous cycle of animals is not completely analogous to the human menstrual cycle. One thing is common to both, i. e., periodic growth. In spayed animals the ovarian hormone can completely substitute for the ovary and bring about all the typical changes of estrus.

In monkeys thirteen series of injections were completed in five spayed monkeys. Two or three injections were given daily to insure nearly continuous action. Typical reddening and swelling of the vulva and surrounding region and reddening of the nipples have been induced, also characteristic changes in the vaginal epithelium. Considerable growth has been induced in the uterus. In seven of ten series bleeding followed discontinuance of injections in three to seven days.

In women four groups of cases were studied. 1. Artificial menopause. 2. Natural menopause. 3. Primary amenorrhea. 4. Scanty menstruation.

There were five series of injections in women with both ovaries removed. The results noted were growth of the uterus during the period of injections followed by regression when the injections ceased. Associated with the growth there were subjective symptoms of pressure and a feeling of weight in the pelvis similar to that previously noted.

The changes in natural menopause are largely subjective. Therefore, too much

emphasis is not to be placed on apparent results in this group. In all cases injected there was diminution in the intensity and frequency of hot flashes.

The effects of injection in primary amenorrhea are less striking. A slight amount of growth occurs, but there are no other constant findings.

Scanty menstruation does not meet ideal experimental conditions, for there is no accurate measure of the function of the existing ovary. The response in this group was variable. One patient who had formerly menstruated scantily once or twice a year was brought to menstruate regularly and more profusely than ever before.

The same person, however, had been treated with thyroid extract two years before with the result that menstruation became regular but remained very scant. This case illustrates the possibilities of the inter-relation of the ductless glands.

From these experiments, combined with earlier ones on lower animals, the following conclusions are made:

1. The ovarian follicular hormone starts the periodic growth processes in the female genital tract.

2. In case ovulation occurs, the corpus luteum in woman, and perhaps in other primates, may continue this anabolic endocrine influence which probably decreases as the next menses approach.

3. Menstruation seems to be partly due to the temporary absence of this secretion after it has been acting a certain time.

4. But since ovulation followed by corpus luteum formation often does not occur, a specific secretion of the corpus luteum is not a necessary causal factor in the menstrual cycle. That the corpus luteum may possibly have a regulatory influence is not questioned.

5. This same substance or a very similar one is probably secreted by or stored in the placenta. Its continuous availability throughout the gestation period would account for the absence of menstruation during pregnancy.

**DR. JAMES C. MASSON of Rochester, Minn., discussed Myomectomy, Hysterectomy and Radium in the Treatment of Uterine Fibromyomas.**

If fibromyomas do not cause symptoms, no treatment is indicated. Radiotherapy is indicated for all patients over forty who have fibromyomas less than 15 cm. in diameter, with menorrhagia as the chief complaint. It is also indicated if the patient is under forty and refuses surgical removal, or if a major operation would carry an added risk. It is also indicated in all cases of fibrosis uteri, or cases in which there are essential uterine hemorrhages.

Surgical treatment of fibromyomas is indicated for most patients less than forty, for most patients with pain or irritability of the bladder, for patients with tumors more than 15 cm. in diameter, for those whose tumors are of the pedunculated or submucous type or are undergoing degeneration or inflammation, for those whose tumors may not be fibromyomas, and for those with complications that require opening of the abdomen.

Abdominal myomectomy is the operation of choice for the majority of patients less than forty. Vaginal myomectomy is indicated if the fibromyoma presents through the cervix. Subtotal abdominal hysterectomy should be performed in women less than forty years of age only when it is necessary to remove the greater part of the body of the uterus and when the cervix is in good condition. Total abdominal hysterectomy is the best operation when any lesion other than carcinoma exists in



the cervix and the abdominal operation is advisable, or when the history suggests the possibility of malignant change in the fibromyoma or an associated malignant condition in the body of the uterus.

DR. JOHN OSBORNE POLAK of Brooklyn summarized in a lantern demonstration the present status of the **Toxemias of Pregnancy**.

The fact that nausea and vomiting of greater or lesser degree occur in over 50 per cent of pregnant women is evidence that there is temporary disturbance of the physiologic balance of the majority of women who become pregnant. Continuous vomiting causes rapid dehydration and rapid emaciation by starvation, lowers the blood pressure, gradually increases the rapidity of the pulse, diminishes urinary output, increases the concentration of the body fluids, and causes the development of general toxic symptoms similar to those found in extreme starvation.

In the mild cases relief may be secured by hygienic and dietetic management. Should the vomiting persist the patient requires rest in bed with absolute isolation, and the fluid loss must be made up by hypodermoclysis, enteroclysis and the intravenous injection of glucose solutions with or without insulin. When glucose alone, or in combination with insulin, fails to produce improvement, small blood transfusions of 300 c.c. of human blood by the direct method, to which is added 500 c.c. of normal saline solution, has given satisfactory results.

The author states that in his clinic it has not been necessary to empty the uterus on account of vomiting for a period of nearly five years.

DR. J. P. GREENHILL discussed **Eclampsia at the Chicago Lying-In Hospital**, giving immediate and late results.

Among the 78 cases of eclampsia analyzed there were 6 maternal deaths (7.7 per cent). If we deduct one moribund, untreated case, the mortality is 6.5 per cent. In 50 per cent the convulsions began before labor, in 20.5 per cent during labor, and in 29.5 per cent after delivery. The maternal mortality for these groups was 10.3 per cent, 0 per cent, and 8.7 per cent, respectively, and the fetal mortality was 41 per cent, 18.8 per cent, and 17.4 per cent, respectively.

The incidence of operative deliveries was 62.5 per cent. While 36.3 per cent of all the labors terminated spontaneously, labor, however, had been induced in 11.3 per cent of them. Hence, only 25 per cent of the patients had both a spontaneous onset and spontaneous termination of labor.

Convulsions ceased after delivery in 78.2 per cent of all the cases where they began ante- or intrapartum. Among the 15 abdominal cesarean sections convulsions began before operation in 12 and in all of these cases the convulsions ceased after operation.

The maternal mortality for the various forms of delivery was as follows: Spontaneous, 3.4 per cent; cesarean section, 6.7 per cent; forceps, 9.5 per cent; and version and extraction, 14.3 per cent. The fetal mortality for these groups was as follows: Forceps, 9.5 per cent; abdominal cesarean section, 17.6 per cent; version and extraction, 28.6 per cent; spontaneous, 30 per cent, and vaginal cesarean section, 100 per cent.

Among the 78 patients, 59 per cent had no prenatal care at all, 23 per cent had very poor observation during pregnancy, and 18 per cent had good prenatal care.

There were five pairs of twins (6.4 per cent). Among the 83 babies there were 23 deaths (27.7 per cent). The fetal mortality of the 75 babies that were alive

when their mothers entered the hospital, however, was only 20 per cent. Of the 15 dead babies which constitute this 20 per cent, only one weighed more than 2,000 grams (4 pounds, 7 ounces). Only 62.7 per cent of all the babies weighed 2,000 grams or more.

Of the 72 patients who left the hospital alive, 60 (83.3 per cent) were traced. Of this number two died of chronic nephritis, 3 now have chronic nephritis and 55 (91.7 per cent) are well. Among eighteen subsequent pregnancies ten ended normally and one is now in progress. One patient had another attack of eclampsia and three had preeclamptic symptoms for which the pregnancies were ended. Hence, among the patients who completely recovered after the attack of eclampsia, 26.7 per cent of those who subsequently became pregnant developed signs and symptoms of toxemia. These patients again recovered completely.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Selected Abstracts

### Cesarean Section

Baumm, P.: Suprasymphyseal Delivery and Its Field of Usefulness. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1923, lxxv, 5.

Baumm reports the results of his last 133 cases of cervical cesarean section among a series of 7,018 labors (1.9 per cent). Two of the mothers died, a mortality of 1.5 per cent. One of these women died of air embolism on the operating table and the other died of infection. These good results were obtained despite the fact that 52 patients were unclean; that is the membranes had been ruptured a long time, many had fever and some even foul-smelling liquor amnii. Of the 135 children (2 twins) three could not be resuscitated. Eight more of the children died before the mothers left the hospital, but seven of these deaths are attributable to the fact that the operation was performed too late. Hence in the interest of the child a cesarean section should be performed early. Likewise, in the interest of the mother early operation should be performed, because of the 43 patients whose convalescence was disturbed, there were 34 who had been listed as unclean cases before operation.

Of the 133 patients operated upon, there were 30 who had their second cesarean section, 5 who had their third, and 1 who was delivered a fourth time by the cervical cesarean section. In general, these operations were no more difficult than those done the first time.

Nearly all the operations performed by Baumm were extraperitoneal (Latzko). The peritoneum was torn in 69 of these cases, however, and in general it might be said that during extraperitoneal cesarean section the peritoneum is torn in about half the cases. No harm results from this injury.

The chief indication for the operation is a contracted pelvis. Other indications are placenta previa, habitual death of the fetus before term and primary atony of the uterus. Operating before the onset of labor had no bad effects.

J. P. GREENHILL.

Brandt: Ten Years of Suprapubic (Cervical) Cesarean Section. *Zeitschrift für Geburtshilfe und Gynäkologie*, 1923, lxxxvi, 564.

From a series of 105 cases occurring in 6,860 labors, the author draws the following conclusions: Extraperitoneal cesarean section shows a preponderance of technical difficulties over the intraperitoneal operation. The loss of time is not considerable. In most cases the child was delivered in 5 to 10 minutes and the operation ended in half an hour.

The transperitoneal procedure cannot stand as an independent method, but must be classified as extra- or intraperitoneal, accordingly as the peritoneal opening is closed before incision of the cervix, or is left open.

The extraperitoneal operation must be divided into pure extraperitoneal and limited extraperitoneal. To the latter belong those cases in which an accidental opening into the peritoneum is closed before opening of the uterus. One disadvantage of the extraperitoneal method is the formation of adhesions, which may cause difficulty on a repetition of the operation. Another disadvantage is the danger of laceration of the peritoneum in head presentations, when the cervical opening is too small and retractors are held too firmly. Here exists the danger of spilling infectious material into the peritoneal cavity. Infection is no contraindication to extraperitoneal section. In extraperitoneal section, the separation of the peritoneum is made easier if the woman has been in labor for some time and the cervix has been obliterated to some extent. The author suggests the name "sectio suprapubica" as an inclusive term for all abdominal cervical sections. Trendelenburg position is not necessary. The longitudinal abdominal incision allows a good exposure of the operative field and because of its simplicity is to be preferred to all others.

Because of its decreased danger of life, cervical cesarean section may have a wider indication than the classic. Even with a dead child, section may be indicated to rescue the mother.

Only in cases of infection or when hemostasis of cellular tissue cannot be assured, should drainage be employed. The placenta should be removed through the incision.

The cervical scar is very strong. Two layers of sutures are sufficient. The mucous membrane should not be included in the suture.

Lumbar anesthesia is preferred. Undesirable action upon the child has not been observed.

Caution should be exercised in performing section after outside operative interference in contracted pelvis because of the high fetal mortality.

Induced premature labor should be employed only in multiparae who already have living children; in all other cases, after a test of labor, section is indicated.

MARGARET SCHULZE.

Essen-Möller, E.: The Place of Cesarean Section in Obstetrics. *Acta Gynecologica Scandinavica*, 1923, ii, 244.

The author believes that the classic and cervical cesarean sections are equally safe for the mother and the child in noninfected cases, but that the cervical cesarean is technically more complicated. It is not yet settled whether the subsequent clinical course is equally simple and undisturbed after the former as after the latter, and with regard to the strength of the scar, it is not yet possible to decide whether the cervical section is to be preferred. The classic cesarean still has its field when it is necessary to deliver the fetus quickly, in placenta previa where severe hemorrhage is feared, and in old primiparae who have no prospect of becoming gravid again.

The classic cesarean section is contraindicated in infected cases unless one intends to perform a Porro operation. It must yield to the cervical operation by means of which it will no doubt be possible to avoid embryotomy on the living fetus even in infected cases. Regarding the two cervical operations the experience gained up to the present time seems to indicate that there is not much choice between them as far as results for the mother are concerned. There is possibly a slight preference for the transperitoneal operation. Regarding the children, the transperitoneal section is decidedly superior to the extraperitoneal and it is, therefore, to be preferred, especially as it is undoubtedly simple technically.

Despite the good results obtained with the cervical cesarean there is still a field of usefulness for the Porro operation. Indications for the latter operation are vaginal atresia and extreme stenosis, and obstructing myomata. In definitely in-

fect cases one may still question whether in some cases the Porro operation does not give the mother a better chance than the cervical section.

In a series of 132 cesarean sections there were 9 fetal deaths (6.8 per cent), but 7 of these infants were dead before delivery, their mothers having had eclampsia and abruptio placentae. One was a monstrosity, hence in reality of 124 cases there was only 1 fetal death and this was due to hemorrhage from the cord, the result of defective ligation.

At the Lund Clinic induction of premature labor has been discarded in favor of cesarean section at term. Nearly all the patients are given a test of labor, but if a patient has previously had dead children due to dystocia, a cesarean section is performed early in labor or even before the onset of labor, regardless of whether the pelvic measurements show a contraction or not.

Cesarean section is performed in cases of eclampsia where the condition of the mother necessitates speedy delivery and where at the same time the cervix is not dilated sufficiently to prevent an equally easy and speedy delivery by this way. The classic section is preferred for these cases. In placenta previa, abdominal operation is indicated in cases where hemorrhage appears to threaten the mother before the cervix is sufficiently dilated for version or other interference. In these cases the operation is performed in the interest of the mother. The author believes that more cesarean sections should be performed for placenta previa.

J. P. GREENHILL.

Esmann, V.: The Place of Cesarean Section in Obstetrics. *Acta Gynecologica Scandinavica*, 1923, ii, 241.

Cesarean section is not natural obstetrics and in spite of its good prognosis, its indications should not be extended to include conditions which can be treated by other means with good results to both mother and child. Such an extended indication is habitual death of the fetus during the last few weeks of pregnancy, for one can induce labor prematurely and secure living children.

A deformed pelvis which offers a real barrier is an indication for cesarean, but in cases of contracted pelvis where the shape of the pelvis is normal and cephalopelvic disproportion will most likely exist at term, labor should be induced prematurely. There is no good ground for permitting these patients to go to term in the hope that they will deliver spontaneously and perform a cesarean section only when one realizes that delivery by the natural passages is impossible.

Cesarean section is useful in such complications as eclampsia, placenta previa and abruptio placentae, but the field for the operation should be extended no further than is absolutely necessary. During the last few years in a series of 23 patients who had contracted pelves, labor was induced prematurely and only one child was born dead.

J. P. GREENHILL.

Newell, Quitman U.: Cesarean Section. *Journal Missouri State Medical Association*, 1924, xxi, 269.

The indications for cesarean section in the writer's opinion are: (1) Contracted pelvis; (2) myoma, large cysts, obstructive growths; (3) carcinoma of cervix; (4) malignancy of bladder and rectum; (5) placenta previa centralis; (6) old primiparae; (7) eclampsia, only in elderly primiparae; (8) extensive scar tissue about cervix and vagina in multiparae.

The elective time for operation is before or at the onset of labor, the indication having been determined beforehand.

Of the types of operation, the conservative cesarean section is suitable in most cases. The other types have their adherents and are of value in selected cases.

F. J. SOUBA.

Portes, L.: Cesarean Section After Exteriorization and Secondary Replacement of the Uterus. *Bulletin de la Société d'Obstétrique et de Gynécologie*, 1924, xiii, 171.

A secundipara was admitted to the hospital at term because of rupture of the bag of waters. Pains did not begin until four days later and at this time the temperature was 100.4°. The next day the liquor amnii had a fetid odor, the fetal head was still above the symphysis and the cervix was dilated about 3 cm. The temperature was 100.8° and the pulse about 160. It was decided to empty the uterus and this was accomplished as follows: Under ether a median supra- and infraumbilical incision was made and the uterus eventrated. There was a marked contraction ring about the baby's neck and the lower uterine segment was very pale. The abdominal wall was sutured to the uterine wall and the uterus incised on the anterior surface. After removing the fetus and placenta the decidua in the lower uterine segment was found to have a diphtheroid appearance. This was swabbed with iodine. The uterine incision was sutured with 8 silk sutures, cleaned with ether and left exposed outside of the abdomen. The first 3 or 4 days after the operation were stormy. The uterus was permitted to remain outside of the abdomen for 34 days, and daily dressings revealed the fact that exteriorization did not greatly retard involution, for on the fifteenth day the uterus was the size of an orange. The lochia were normal. Around the stitch holes in the uterus, however, pus formed and these pus pockets soon ran together. On the twentieth day a secondary suture of the uterine wall with catgut was done. The infection had extended down to, but not through, the uterine mucosa. This secondary suture healed readily.

On the thirty-fourth day after operation the uterus showed no trace of infection, and it was replaced in the pelvis without any difficulty, for there were no adhesions. The patient left the hospital fifty-one days after the first operation and at that time the uterus was freely movable.

J. P. GREENHILL.

Planell, D. Augusti: Clinical Study of the Portes Cesarean Section. *Revista Medica de Barcelona*, 1925, iii, 501.

The technic of the Portes operation is not complicated. The abdomen is opened as in the classic cesarean section, and the uterus is lifted outside the abdominal wall. The parietal peritoneum is sutured tightly about that part of the uterus which lies in the abdominal incision, and the abdominal wall is closed. Care is taken to close the most inferior portion of the abdominal incision tightly, consuming as little time as possible in doing this, because, in a uterus which has been drawn outside of the abdominal cavity and which is in a condition of anteversion, there is danger of compressing the fetal placental circulation, an act which might result in the death of the fetus.

Immediately after closing the abdominal incision the uterus is covered with towels or gauze and is incised as in a classic cesarean. Fetus and placenta are removed and the uterine incision is sutured. The uterus should then be washed with ether and covered with gauze saturated with warm lactic or acetic acid solution.

The patient is watched very carefully during the first fifteen days of the puerperium for edema of the extremities, edema of the adnexa, and for any phlebitis.

When the uterine infection has disappeared the uterine incision, if necessary, is resutured, and the uterus is replaced in the abdominal cavity.

In replacing the uterus it is necessary first to break up any adhesions that may have formed between the uterus and the abdominal wall. This can be done with the fingers.

The author states that this operation is of great value in those cases where there is evidence of an overwhelming infection, because by this method the uterus can be spared, a secondary suture of the uterine wall is possible, and the infection is kept from the peritoneal cavity.

J. M. PIERCE.

**Fournier, C.: Enucleation of the Ovum in the Cesarean Operation.** *Presse Médicale*, April 3, 1926, p. 421.

After a considerable experience with cesarean section, having performed the operation 400 times, the author has now developed a method of removing fetus, placenta and membranes intact in one mass, the opening of the membranes and the removal of the fetus therefrom being performed by an assistant at another table. He has followed this technic in sixty cases. The operation should be performed as near term as possible, before labor has begun.

The procedure is as follows: (1) Incision 18 cm. long, followed by exteriorization of the uterus, temporary closure of the incision with clamps behind the uterus; (2) incision of the uterus and enucleation of the ovum intact.

The location of the placenta is determined at the first cut into the uterine wall, as blood escapes freely and in jets if the placenta is anteriorly placed. When the placenta is on the posterior wall the incision in the uterus (18 cm. long) is carried carefully down until the membranes are exposed for three or four cm. The scissors are now used and the incision is completed to its full length. The open hand is introduced and the membranes are separated from the uterine wall. The most convenient hand is then introduced into the uterus toward the pelvis behind and even below the lower pole of the fetus, pressure is made from below upwards, and the ovum is expressed intact. At times it is necessary to retract the lips of the wound posteriorly and to press lightly upon the posterior uterine wall. If the placenta is on the anterior wall, it is detached first, and then the above procedure is employed. An iodized compress is introduced from above downward into the cervix and the operation completed as usual.

There is no hurry about opening the membranes; the author thinks that the child cries more readily if at least one minute elapses before this is done. There is no bleeding from the placenta during this time. All the children delivered in this manner have been born alive.

The operation is simple, clean (no spilling of possibly infected amniotic fluid), and "elegant." The author feels that this method should be employed whenever possible, and that the low section is only exceptionally indicated. This new technic is, of course, not available when the membranes have already been ruptured at the onset of labor.

E. L. KING.

**Fleurent, M.: The Low Cesarean Section.** *Bulletin d'Obstétrique et de Gynécologie*, 1925, xiv, 615.

Fleurent reports ten of these operations which he performed in the last three years. Of these patients four were "clean" and six were "unclean." All four in the former group recovered. In two of the latter group, forceps had been attempted before operation. In five cases there was bony dystocia and in the sixth

an ovarian cyst. All the children left the hospital in good condition, but one mother died. Autopsy revealed purulent peritonitis which had its origin in the uterine incision. The entire wound had been opened by a collection of pus.

J. P. GREENHILL.

**Brindeau, A.: The Low Transperitoneal Cesarean Section.** Bulletin de la Société d'Obstétrique et de Gynécologie, 1926, xv, 162.

In 1923 Brindeau performed twenty-one low cervical operations with a mortality of 18.04 per cent; all these cases were infected. Since April, 1924, he has performed eighty-eight low cervical cesarean sections with only one death (1.1 per cent). He feels that the low operation even in clean cases is superior to the classic operation. After this operation one seldom finds secondary peritonitis, adhesions, fistulae, and rupture of the wound, complications with which one must reckon in choosing the classic operation. Nearly all the operations were performed under spinal anesthesia. There are certain dangers in this form of anesthesia, however, for among 231 spinal anesthetics in pregnant women there were two deaths.

J. P. GREENHILL.

**Portes and Risacher: The Low Transperitoneal Cesarean Section.** Bulletin de la Société d'Obstétrique et de Gynécologie, 1926, xv, 275.

Among twenty-eight cervical cesarean sections performed for cephalopelvic disproportion, twenty-two were done under general anesthesia and six under spinal. The cases were divided into three groups. In the first or noninfected group, of which there were six cases, the convalescence was perfect. In the second or "suspect" groups, of which there were nineteen cases, there were three cases of prolonged fever and one patient died of postoperative peritonitis. The third group consisted of a single definitely infected case which ended in recovery.

J. P. GREENHILL.

**Couvelaire and Portes: Concerning the Low Transperitoneal Cesarean Section.** Bulletin de la Société d'Obstétrique et de Gynécologie, 1925, xiv, 647.

The authors have performed the low or cervical cesarean section thirty times in both clean and unclean cases. Ether was used fifteen times, chloroform seven times, and spinal anesthesia eight times. There was one death, but this could not be attributed to the operation. The authors believe that the cervical operation is more difficult to do but at the same time is more satisfactory than the classic operation, because the suturing is done in the noncontractile portion of the uterus and will not be subjected to the powerful uterine contractions which sutures in the body of the uterus must withstand. Convalescence is much smoother than after the classic operation and the cervical operation is less dangerous in the cases where the uterine contents are not absolutely sterile.

J. P. GREENHILL.

**Cathala, V.: The Value of the Low Transperitoneal Cesarean Section.** Bulletin de la Société d'Obstétrique et de Gynécologie, 1926, xv, 37.

The author has performed three low or cervical cesarean sections and objects to the operation on the following grounds: The operation is performed with the patient in a sloping position and the liquor amnii hides the field of operation. The lower uterine segment hugs the baby's head tightly, especially when the membranes are ruptured. This necessitates great care to avoid injuring the child and may



result in hemorrhage. The extraction of the fetus is difficult. In case of hemorrhage it is easier to control it in the classic operation than in the cervical. The claim that there is less risk of infection of the peritoneum in cases of infected liquor has not been demonstrated. The uterine wound in the lower uterine segment is not stronger but weaker than the wound in the fundus of the uterus. In clean cases the classic operation is superior to the cervical, whereas in unclean cases they have equal value. In frankly infected cases hysterectomy or exteriorization of the uterus should be done. In a series of 110 classic operations the author had three maternal deaths (2.7 per cent), one from shock and two from peritonitis.

J. P. GREENHILL.

**Kakuschkin, N.:** Sectio Cesarea Vaginalis Vera. Monatschrift für Geburtshilfe und Gynäkologie, 1925, lxxviii, 101.

Objection has been made to the term vaginal cesarean section because there is not only no analogy in the indication between the abdominal and the vaginal cesarean section but also because the technics are different. In the vaginal operation the incision is made in the cervix while in the classic (abdominal) cesarean section the cervix is not incised. The author believes it is harmful to incise the cervix in doing a vaginal cesarean section and he, therefore, incises the uterine body through the vagina without splitting the cervix. To do this the peritoneum is cut first. After removing the fetus and the placenta the author cures out the decidua. Three cases are reported. At the time of operation the first patient was three months pregnant, the second was six months pregnant and the third was in the fifth month of pregnancy. All were multiparae and in all the abortions were done for social reasons.

The advantages of this operation are easy, and quick access is had to the interior of the uterus and the visibility of the uterine cavity. As the vaginal cesarean section is ordinarily done there is difficulty in inserting the finger through the internal os and one works in the dark. The second advantage is the very small amount of traumatism which accompanies the new operation. After the old operation there is usually an ugly scar.

J. P. GREENHILL.

**Küstner:** Are Cesarean Section Children Apneic or Asphyxiated? Zeitschrift für Geburtshilfe und Gynäkologie, 1925, lxxxv, 567.

The author attempted to determine by animal experimentation how much the diminished inspiratory excitability so often seen after cesarean section was due to the anesthetic, and how much to some influence of the operation itself. He found that animals delivered without narcosis breathed immediately and regularly and showed evidence of good tone of the voluntary musculature. In cases where the mother was deeply anesthetized, even though only for a short time, respiration was established with difficulty or not at all and the general picture was one of extreme apathy; the lungs on postmortem examination showed lack of proper inflation. This condition the author considers to be an asphyxia caused by the narcosis, and it is in many ways similar to the state induced by an overdose of anesthetic in an adult. Children delivered under anesthesia for fetal causes rarely show this state, since the condition necessitating such delivery is usually one which disturbs the placental interchange and hence interferes with the passage of anesthetic, as well as of oxygen, to the child, thus allowing the accumulation of CO<sub>2</sub>, which acts as an efficient respiratory stimulant. Furthermore, the cerebral pressure on the child during the pains seems to increase the excitability of the respiratory center.

The cesarean section child receives so much oxygen from the mother and its blood

contains so little CO<sub>2</sub> that it need not breathe, that is, it is born in a state of apnea. Oxygen is very rapidly used up in the first few moments after birth, however, and CO<sub>2</sub> is produced by the heart activity, loss of body heat, etc.; hence, unless its respiratory excitability is too much depressed by the narcosis, the child will breathe very shortly. If it does not breathe, it passes quickly into a state of asphyxia from which it may be rescued only by vigorous artificial respiration and the administration of oxygen.

MARGARET SCHULZ.

Müller, P.: Spontaneous Rupture in the Scar after a Transperitoneal Cervical Cesarean Section Done for Placenta Previa. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxx, 249.

In April, 1922, Hüssey performed a transperitoneal cervical cesarean section for placenta previa in a patient's home. The conditions were very unfavorable. The operation was performed on a bed, the light was poor, and the only assistant was a nurse. The family physician administered the anesthetic. Severe bleeding occurred after closure of the uterus, and after the operation the patient had an infection and a double femoral thrombosis. This patient then became pregnant again in September, 1923. On June 14, 1924, she had uterine contractions, but the midwife in attendance found the cervix closed. Pains recurred on the sixteenth and nineteenth of June. On June 20 the patient was taken to a hospital because she had a severe hemorrhage. A diagnosis of premature separation of the placenta was made and laparotomy performed. A rupture 10 to 12 cm. long was seen in the lower uterine segment where the incision had been made in the first operation. The dead child which was still within the uterus was delivered and a Porro operation performed. The author believes that when a cervical cesarean section is done in a case of placenta previa the scar becomes a *locus minoris resistentiae* in subsequent pregnancies. The scar in this case, however, showed nothing abnormal upon microscopic examination.

J. P. GREENHILL.

Wetterwald, Max: Uterine Rupture Following Low Cervical Abdominal Cesarean Section. *Zentralblatt für Gynäkologie*, 1926, 1, 592.

Of a total of 201 cervical transperitoneal cesarean sections, in 100 instances simultaneous sterilization was performed; in the remaining 101 cases nothing was done to impair or prevent further pregnancies. Of these 45 went through one or more subsequent full-term deliveries. Low cervical abdominal section had to be repeated in eleven, in the majority of these no trace of an old scar could be seen. Adhesions were not found. The remaining twenty-six patients were delivered *per vias naturales* of forty children. One patient went through six subsequent spontaneous deliveries, another through four, two through three, two through two subsequent deliveries without disturbance. Eight of the subsequent spontaneous deliveries occurred within fifteen months after the first cesarean. Uterine rupture at the end of the second stage of a full-term labor, five years after the first cesarean, occurred in one instance. The writer points out that rupture is apt to occur when the placenta is inserted over the old scar. Cervical incision should be avoided in cases of placenta previa. A compilation of 3,000 cervical cesarean sections performed in sixty-one large clinics in the world is presented, showing that only ten uterine ruptures so far have been recorded. This very low percentage proves the superiority of the low cervical over the old classic incision. Factors which increase the danger of a uterine rupture are: Poor suturing of the uterine wound, infection of the wound, extension of the incision into the uterine muscle above the cervix, intrauterine manipulations for the purpose of terminating labor and placenta previa in a subsequent pregnancy.

GROVER LIESE.

Weymeersch and Keiffer: Rupture During Labor of an Old Cesarean Scar. *Bruxelles Medical*, 1925, xxxii, 1039.

These authors report the case of a woman thirty-two years of age, who had undergone a cesarean section nine years previously. Examination of the existing pregnancy near term revealed no pathology other than slight contraction of the pelvic outlet. Four days before the expected date of confinement the patient began to experience slight contractions. Abdominal examination the following morning gave the impression that the uterine wall was extremely thin. Vaginal examination showed the head, which previously had been engaged, to be floating above the superior strait, and there was some dark colored blood in the vagina. The patient's general condition was normal, but the fetal heart could not be heard. Because it was felt that either rupture had taken place or that the uterine wall had become extremely thinned out it was decided to open the abdomen. On incising the peritoneum the fetus, contained within the membranes, was found to have been extruded from the uterus, but still attached to the latter by the placenta. The sac was incised and a fetus which had been dead about forty-eight hours removed. The area of rupture was so extensive that it was decided to do a supra-vaginal hysterectomy.

THEODORE W. ADAMS.

Andérodias and Balard: Obstetric History of a Woman Who Had Eight Pregnancies after a Cesarean Section. *Bulletin de la Société d'Obstétrique et de Gynécologie*, 1926, xv, 50.

The authors give in detail the history of eight pregnancies which followed a cesarean section. Four of the pregnancies ended prematurely, but this case well illustrates that cesarean section does not necessarily limit fecundity. The uterine scar was evidently very strong, because in the last delivery the child was extracted with a cranioclast after forceps had failed. The dystocia was caused by a contraction ring in the body of the uterus.

J. P. GREENHILL.

Tofte, A.: Delivery per Vias Naturales in Women Who Have Previously Been Delivered by Cesarean Section. *Acta Gynecologica Scandinavica*, 1922, i, 403.

The author reports five cases in which delivery took place through the vagina after previous cesarean section. From these cases and from the reports in the literature, he concludes that if the indication for the first cesarean section is no longer present one should give the patient a test of labor; for experience shows that most women deliver from below without trouble. The scar in the uterus frequently shows a great deal of resistance as indicated by subsequent repeated pregnancies in the same patient or difficult labors. In one case twins were delivered after cesarean section and in another version and extraction were performed, and in neither case did the uterine scar weaken. Spontaneous delivery in a patient who has previously had abdominal section does not mean that a rupture may not occur in the third or a subsequent labor.

All women who become pregnant after a cesarean must be watched carefully during pregnancy. During labor preparations must be made for operation which must be performed immediately upon the slightest suspicion of rupture of the uterus. Experience shows that only a small number of women who have cesarean section ever become pregnant again. This the author attributes to the fear of another abdominal operation rather than to the displacement of the adnexa which some authors believe to be the cause.

J. P. GREENHILL.

**Thorne: Normal Delivery After Traumatic Rupture of Uterus.** *British Medical Journal*, 1921, No. 3143, p. 459.

The author reports an interesting case of traumatic rupture of the uterus occurring in a woman about five months pregnant. She was operated upon about fifteen hours after the accident. The woman became pregnant about nineteen months later and was delivered after normal labor at full term with no complications except a fairly severe postpartum hemorrhage.

F. L. ADAIR.

**James, Mary Latimer: Report of Case with Unusual Indication for Cesarean Section.** *The China Medical Journal*, 1925, xxxix, 498.

The author reports a case of a primipara, aged twenty-four years, whose thighs were bound closely together by a very dense, gristly cicatrix, continuous anteriorly with the skin of abdominal wall with not even a pin point aperture. The deformity was the result of a burn suffered at least ten years previously. Posteriorly the trouble had not extended to the buttocks and perineum, nor had it involved the posterior portion of the labia. The thighs could not be separated sufficiently to permit passage of even a moderate-sized infant.

Cesarean section was done at term and a male infant of 6 pounds 2½ oz. was delivered.

One month after delivery, a plastic operation was done on the thighs and the anterior portion of the vulva was built up. Convalescence from this second operation was prolonged and she developed tertian malaria, necessitating intramuscular injections of quinine to control it.

On leaving the hospital she was able to walk like a normal individual. Condition of the vagina and vulva were such that it seemed she should give birth to future children in the normal way.

FREDERIC J. SOUBA.

**Kickham: Uterus Septus Duplex.** *Surgery, Gynecology and Obstetrics*, 1922, xxxv, 443.

Kickham performed cesarean section on a woman at term on account of toxemia. He found a double uterus divided by a septum one-half inch in thickness. In each cavity was a live female child, one weighing 6, the other 6⅞ pounds.

R. E. WORUS.

### Forceps Extraction

**Gamper, A.: The Frequency of Forceps Operation and Fetal Mortality.** *Monatsschrift für Geburtshilfe und Gynäkologie*, 1923, lxiv, 297.

Among 5,505 labors there was a fetal mortality of 3.6 per cent up to twenty-four hours postpartum. Of these, 1.1 per cent died before labor, 1.9 per cent during labor, and 0.6 per cent after labor. The frequency of forceps operation in the entire series was 2.1 per cent. In general, forceps were not applied until six or eight hours after complete dilation of the cervix and two hours after the head was visible. The forceps was the last resort after all other means had failed. For the forceps cases the fetal mortality was 4.3 per cent, which was not much higher than the total fetal mortality (3.6 per cent).

The author attempts to explain the relation between cerebral hemorrhages and the application of forceps. Intracranial hemorrhage is due to three factors: (1) venous stasis; (2) compression of the head and marked overlapping of the skull

bones during labor, especially during the rapid extraction of the after-coming head, and (3) laceration of tissue with or without a special predisposition. Venous stasis is the most important predisposing factor and this increases with the duration of labor. It is, therefore, conceivable that the disturbances in the central nervous system due to intracranial and intracerebral hemorrhage can be avoided by timely delivery with forceps. If interference is delayed a long time irreparable damage to the nervous system may result before the forceps are applied; or vessels which are dilated to a maximum degree from long-continued stasis are ruptured by even gentle compression of the forceps. Such fetal deaths are not attributable to the forceps but to the obstetrician.

J. P. GREENHILL.

**Rittershaus, G.:** Frequency of Forceps and Fetal Mortality. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxi, 182.

Among 17,942 women at the Freiburg Clinic, 1,491 (8.32 per cent) were delivered with forceps. The latter were applied in the interest of the child more than twice as often as in the interest of the mother. The total fetal mortality was 3.78 per cent, but among the 678 deaths there were eighty-three macerated babies and 138 children had died before the mothers were admitted to the hospital.

The indications for forceps delivery on the part of the mother are uterine atony, a second stage of four hours, threatened infection, fever, acute infections and heart failures. On the part of the child, the indication for interference is a heart rate of less than 100 during a pause between uterine contractions. Since instituting the four-hour rule for the second stage (1918), the number of forceps deliveries has increased, but the fetal mortality has decreased. There was no increase in maternal mortality or morbidity. In the Freiburg Clinic it has been shown that the dangers of the second stage of labor are greater than those of the first stage and also that the delay in expulsion of the child after a few hours endangers the child.

J. P. GREENHILL.

**Berkeley:** The Use and Abuse of Obstetric Forceps. *The Journal of Obstetrics and Gynaecology of the British Empire*, 1923, xxx, 413.

Forceps are too frequently used because of inaccurate observation and diagnosis, and in the face of little or no knowledge of the mechanism and stages of labor.

The use of forceps except as tractors is seldom justified. Manual rotation of the head in posterior positions usually makes instrumentation unnecessary for this part of the mechanism. Haste in extraction is damaging and almost never necessary. When great force had to be used in delivery forceps extraction was not the correct procedure for the case. While extraction diminishes suffering during labor, the increased risk and the possibility of lifelong suffering from injury and infection rules out instrumentation for the relief of pain. Before using forceps the practitioner should ascertain the relative size of the pelvis and head, the condition of the genital canal, the strength of the contractions and the condition of the fetus. There is no definite time limit for delivery, and, the mother and baby being in good condition, a lingering second stage is less harmful than rapid delivery. Eighty per cent of border line cases of disproportion deliver spontaneously. High forceps delivery is rapidly being recognized as an abuse, not an aid to the obstetric art. At best only a small percentage of babies can be delivered alive in such cases, irreparable damage is done the mother, and, where delivery is not effected, cesarean section is no longer safe.

Forceps were employed 1,336 times in 17,738 deliveries (7.7 per cent) at the London Maternity Hospital. Fourteen maternal deaths occurred in the 1,336

cases. Seventy-two infants died during or immediately following labor; thirteen died later. In 7.5 per cent of cases babies were born in asphyxia from which 18 per cent died. Facial paralysis occurred in 3.5 per cent of cases, Erb's paralysis in 0.5 per cent. The indication for delivery was prolonged second stage in 1,041 cases. Fourteen babies died and 11 were injured in forty-nine cases where forceps were applied for arrest in or above the pelvic brim. Eleven babies died and seventeen were injured in 218 cases of arrest below the brim. Eighty-two per cent of the babies were born dead or died where attempts at forceps delivery before admission had failed. Fever followed the application of forceps in thirty per cent of the cases and was severe in half that number.

H. W. SHUTTER.

**Shannon:** The Failed Forceps Case and Its Treatment. Transactions of the Edinburg Obstetrical Society, Session lxxxii, p. 120.

The term "failed forceps" is applied to cases where attempts at extraction with instruments have failed. In 2,720 obstetric cases seen by the author and his staff, seventy or 2.6 per cent came in this category. Fifty-two per cent were due to pelvic contractions. In most of these the obstetric history and degree of contraction should have warned the practitioner before the onset of labor. Occiput posterior position of the vertex was the second most common cause of failure. Errors of flexion, unusually large fetuses and contraction ring dystocia accounted for from ten to twelve per cent of cases. In several cases no cause for either the application or failure of forceps could be found, the women later delivering spontaneously.

Five mothers (7 per cent) died in the puerperium, one of shock and four of infection. Fifty per cent of women developed temperature in the puerperium. Invalidism, continued ill health, ruptured uterus (2 cases), fistulae, rupture of the symphysis pubis (2 cases) and even insanity were some of the sequelae in the author's cases. Sixty per cent of the infants were stillborn and many died later.

The difficulties of these cases come more from the faulty judgment of the men handling them than from the conditions themselves. In the hands of competent men the treatment would have been clean cut. Once interference has failed the question to determine is: Can delivery be effected from below? Frequently it can and is effected spontaneously. In some cases the second forceps application is successful. Occasionally cases must be treated medically before interference can be attempted. Experience shows pubiotomy unsuitable in these cases; the morbidity and mortality equal that following cesarean section. Where posterior position of the occiput is delaying engagement it might be wise to rotate the occiput anteriorly and apply forceps when the emergency demands. Where forceps have been applied to a brow presentation the author delivers by version if the child is still alive, otherwise by craniotomy. Gentle traction with the forceps is tried where morphine and anesthesia will not relieve contraction ring dystocia.

In cases where examination shows delivery from below impossible treatment lies between cesarean section and craniotomy. In the potentially infected case, particularly in the presence of cervical and vaginal lacerations the author prefers craniotomy to the increased maternal risks of cesarean section. Cesarean hysterectomy does not improve the outcome in these cases. When the baby is dead or in a dying condition craniotomy is indicated.

H. W. SHUTTER.

**Phillips:** An Address on the Failed Forceps Case. The Lancet, 1926, cex, 113.

If forceps fail to effect delivery, either because they slip or because no progress is made in spite of strong traction, examinations with special attention to the

following points should be made: The general condition of the patient; the abdomen, including pelvic measurements and notation as to the position of the head in relation to the pelvic brim; the condition of the child, particularly the position of the occiput; the vagina, the presence of lacerations; edema of the perineum, vulva, or vagina; the existence of a tumor in the pelvis.

The author points out that the more prominent causes for failed forceps are: unrotated or partially rotated occipitoposterior positions, a contraction ring around the neck of the child, pelvic tumors, and contracted pelves.

The treatment of each of these conditions is then discussed by the author. He emphasizes the importance of recognizing posterior positions, and where early rupture of the membrane has taken place or where the patient is very fat or nervous and position is unsatisfactorily made out the use of vaginal examination is encouraged. It is wise to pass the whole hand into the vagina over the fetal head until the face or neck is reached, thus noting exactly the position of the occiput.

Contraction ring cases should be treated by small doses of morphia.

Pelvic tumors complicating labor are not common.

When the forceps fail to deliver a head in the pelvic cavity, it is doubtful whether any advantage is to be gained by version, while in many cases in which the head cannot be pushed up easily, the practice is fraught with considerable danger, especially the risk of rupture of the uterus.

In extreme degrees of pelvic contraction, cesarean section is the only rational treatment, irrespective of the duration of labor. Similarly in moderate degrees of contraction when the child is dead perforation is recognized as the correct treatment, if forceps fail and version is contraindicated. In cases of moderate contraction in which forceps have failed and the child is still alive, there is a choice between cesarean section and perforation of the living child. The tendency today is to extend the scope of cesarean section to these cases, irrespective of the added risk to the mother. The author believes that proper antenatal supervision, ending in induction of labor some time between the thirty-sixth and thirty-eighth week of gestation is very important in the prevention of failed forceps and difficult forceps.

NORMAN F. MILLER.

Das, K. N.: The Bengal Forceps. The Indian Medical Gazette, 1923, lviii, 22.

The average measurements of the pelvis in Bengali women are about  $\frac{7}{8}$ ths of those of British women. The average weight of a Bengali full-term baby is about six-sevenths the average weight of a British baby; while the size of the head of the former is proportionately smaller. British forceps frequently cause injuries to the mother.

The ordinary Simpson forceps were modified making them lighter and more delicate, weighing one pound. The pelvic curves were made a little more pronounced and the distance between the shanks near the joint wide enough to admit the forefinger. These special forceps are found suitable for Indian women generally.

F. J. SOUBA.

Hernstein, A.: The Results of the High Naegele and Kielland Forceps. Monatschrift für Geburtshilfe und Gynäkologie, 1923, lxii, 139.

The results of eighty-five high Naegele and forty-three Kielland forceps operations were studied by the author.

For the Naegele operations there was a maternal mortality of 3.52 per cent. The extensive injuries were as follows: Four complete perineal lacerations, eight

deep vaginal tears, five extensive cervical lacerations and six bladder injuries of which five resulted in urethral fistulae. Only sixty-one out of the eighty-five children remained alive.

Of the forty-three Kielland forceps operations, one mother died (from cardiac decompensation). The extensive injuries were as follows: Two complete perineal lacerations, three deep vaginal tears, two extensive cervical lacerations, and one bladder fistula. Seven of the forty-three babies died.

The author concludes that the Kielland are better than the Naegele forceps where the head remains high in the pelvis, because traction and hence delivery require less force. We should not, however, be overenthusiastic about the Kielland forceps. Because of the difficulty in applying the blades; an accurate diagnosis must be made and much obstetric knowledge and experience are essential. The use of the Kielland forceps does not justify an extension of the indications for high forceps.

J. P. GREENHILL.

**Schubert: Experiences with the Kielland Forceps.** *Zeitschrift für Geburtshilfe und Gynäkologie*, 1923, lxxxvi, 134.

The author's experience with the Kielland forceps comprises thirty cases, with a fetal mortality of 0, including five high forceps, one face presentation, one brow and ten cases of deep transverse arrest. From this experience, he concludes that, used as high forceps, the Kielland is markedly preferable to the Tarnier instrument. In definitely contracted pelvis, it cannot make delivery by the natural passages possible any more than can the Tarnier instrument and, therefore, could never, even in a single case, avoid a definitely indicated cesarean section. In cases of mild disproportion between head and pelvis, it may not be possible to deliver more children than with the Tarnier forceps, but they can be delivered much more easily and with less damage.

In all atypical presentations, as face, brow, occiput posterior, deep transverse arrest, and in fact in all cases where complicated movements must be made of the child's head within the pelvis, the Kielland forceps are markedly preferable to the classical forceps.

For ordinary low forceps operations, they are at least as good as the classical forceps. In any case, therefore, where the definite indications for a forceps operation are present, the Kielland instrument may be depended upon to perform it with the minimum of trauma for both mother and child.

MARGARET SCHULZE.

**Horn, O.: The Kielland Forceps.** *Acta Gynecologica Scandinavica*, 1923, ii, 322.

In a series of seventy cases delivered with the Kielland forceps there was one maternal death, and this was due to pulmonary embolism on the fourteenth day. No mother suffered a marked laceration. Of the seventy children, six were born dead, but three of these were dead before the application of the forceps. None of the other three deaths could be ascribed to the forceps.

The use of the Kielland forceps demands an exact knowledge of diagnosis and more experience than use of the axistraction forceps.

J. P. GREENHILL.

**Eisenberg, C.: Experiences with the Kielland Forceps.** *Medizinische Klinik*, 1924, xx, 1694.

The author reviews the histories of seventy patients who were delivered with the Kielland forceps. In four cases the head was above the inlet, in fifty-six in the middle of the pelvis and in ten on the perineum. In twenty cases the cervix was



not fully dilated and in six instances incisions had to be made in the cervix. Four of the mothers died, three of sepsis and one of peritonitis after a laparotomy. The severe maternal injuries were a vesicovaginal fistula which was diagnosed before the application of the forceps and a cervical laceration which required repair. In not one case was there a third degree laceration. Ten babies died, of which four were stillborn; one died intrapartum; two had tentorial lacerations; one had syphilis; one had a craniotomy, and one had a skull fracture from forceps which had been applied before the patient was admitted to the hospital. In the majority of the cases the anterior blade was inserted into place by making it wander. In four cases the Kielland forceps were successful where the Naegele had failed. The author feels that the Kielland forceps is superior to all other types of forceps. It not only replaces the classic type of forceps but also extends the use of forceps so that mothers and infants may be saved in certain cases where the Naegele forceps are unsuccessful.

J. P. GREENHILL.

**Henkel, M.: Is the Kielland Forceps a Universal Instrument for the General Practitioner?** *Medizinische Klinik*, 1924, xx, 71.

In the Jena Clinic the incidence of forceps deliveries for the past 14 years was 4.5 per cent, for which the fetal mortality was 7.7 per cent. When labor comes to a standstill due to uterine atony, forceps are not used but pituitary preparations are employed. In other cases episiotomy makes the use of forceps unnecessary.

The most frequent indication for forceps delivery is fetal asphyxia. In these cases delivery must be accomplished quickly and without damage and this is accomplished with the Naegele forceps if the fetal head is in the pelvic cavity. Where the head is high, however, and particularly if the head is not fixed and not moulded, the Kielland forceps give better results.

The insertion of the anterior blade as advocated by Kielland is dangerous, as shown by such conditions as rupture of the uterus and injury to the umbilical cord. In cases of contracted pelvis where the head is high the results with the Kielland forceps are not very satisfactory. The value of these forceps, while a very definite one, is, however, being violated by errors in judgment regarding its use. The new forceps should not be given to the practitioner as a universal instrument.

J. P. GREENHILL.

**Aza, Vital: Should the General Practitioner Use Kielland Forceps?** *Revista Espanola de Obstetricia y Ginecologia*, 1924, ix, 377.

Aza warns against the indiscriminate use of the Kielland forceps by the general practitioner whose knowledge of the instrument has been gained entirely from the reading of the various enthusiastic reports of its use gleaned from the literature (especially German). He calls attention to the fact that the original idea of the inventor was to be able to apply forceps to unengaged heads and through undilated cervixes. He warns against the danger of rupture of the lower uterine segment and of trauma to the umbilical cord if the method of application of the anterior blade of the forceps as advocated by Kielland is carried out.

THOS. R. GOETHALS.

**Wyder, T.: The Significance of the Kielland Forceps in Obstetric Practice.** *Schweizerische Medizinische Wochenschrift*, 1924, liv, 253.

The author believes that the Kielland forceps, just like the axistraction forceps, will in time lose its popularity. The former, however, is a definite improvement in the construction toward an ideal forceps. There is no doubt that the new forceps

with its almost absent pelvic curve is ideal for cases of transverse arrest of the head and in deflection attitudes, such as brow and face presentations, because of its biparietal application. The Kielland forceps even when properly applied has sometimes injured the mother or the baby, but in some of these cases the operators were at fault because the proper conditions were not present for a forceps delivery.

The constant repetition of the ease with which the new forceps can be used might, in the writer's opinion, have a bad influence, for high forceps operations will again become frequent. Most obstetricians, however, feel that the indications for a forceps operation should not be extended by the general practitioner simply because he has the Kielland forceps. As Kielland himself says, the instrument should not be used to overcome bony resistance.

For the specialist the new instrument should supplement but not entirely replace the older types of forceps. It may enable one to avoid an occasional cesarean section or a craniotomy on a living baby. The general practitioner, however, should have only one instrument, an old type, and he should know its limitations.

J. P. GREENHILL.

Heinleinf: Experiences with Kielland Forceps. *Zentralblatt für Gynäkologie*, 1925, 1, 1485.

To attempt a forceps where there is a possibility of later cesarean section is taking too great a chance with the mother's life, and likewise version is contraindicated after an attempt at forceps. The writer has made use of the Kielland instrument in some 37 cases with good results for the most part but not invariably. The instrument is not entirely harmless and in three cases there was serious damage to the cervix, though the bladder was not torn. To obtain the good results claimed by the various operators a man must be a Kielland specialist. This forceps cannot be recommended for practitioners.

LITTLE.

Nürnberg: Forceps on the After-Coming Head. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1922, lvii, 305.

There are two ways to account for the deaths of children who are born with the head last; namely, asphyxia and injury (fractures, paralyzes and intracranial hemorrhages). For those who died of asphyxia, manual extraction of the head did not help and to those who had injuries, it did harm. Forceps, however, can save babies and are indicated in all cases where the Smellie-Veit or Wiegand-Martin maneuver does not yield results within a reasonable length of time. In all cases where the face is directed anteriorly, no attempt should be made to rotate the face posteriorly but forceps should be applied immediately. The forceps should always be applied under the child. The author is very well satisfied with his results and emphasizes the importance of having the forceps ready for use at every case of breech presentation.

J. P. GREENHILL.

Fink, K.: Kielland Forceps on the Breech. *Zentralblatt für Gynäkologie*, 1925, 1, 1490.

Fink made use of the Kielland forceps on an impacted breech presentation and was surprised at the remarkable facility of delivery. The child was born dead, but the operation was a remarkable success.

LITTLE.

Hermstein, A.: Forceps Applied to the Breech. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxxi, 125.

The author reports four cases of breech presentation which were successfully delivered with forceps. He believes that in a breech presentation when the hips are in the pelvic cavity in such a way that the bisiliac diameter runs transversely, the condition is unphysiologic and as anomalous a position as transverse arrest is in head presentations. In these cases extraction alone will not suffice because rotation of one hip to the front is necessary. For this purpose the Kielland forceps are especially adapted.

J. P. GREENHILL.

## BOOKS RECEIVED

NERVOUS AND MENTAL DISORDERS FROM BIRTH THROUGH ADOLESCENCE. By B. Sachs, consulting neurologist to the Mount Sinai and Montefiore Hospitals, etc. and Louis Hausman, instructor in neuroanatomy, Cornell University Medical College, etc. With 110 illustrations including three full page plates. Paul B. Hoeber, New York, 1926.

ERGEBNISSE DER MEDIZINISCHEN STRAHLENFORSCHUNG. Herausgegeben von H. Hohlfelder, Frankfurt a.M., H. Holthusen, Hamburg, O. Juengling, Tuebingen, und H. Martius, Bonn a.Rh. Band II. Mit 520 teils farbigen Abbildungen im Text und auf 3 photographischen Tafeln. Verlag von Georg Thieme, Leipzig, 1926.

ELECTROTHERMIC METHODS IN THE TREATMENT OF NEOPLASTIC DISEASES. By J. Douglas Morgan, M.D., formerly radiologist, Ross Pavilion, Royal Victoria Hospital, Montreal, etc. etc. Illustrated with 36 line and half-tone engravings. F. A. Davis Company, Philadelphia, 1926.

EVOLUTION AND GENETICS. By Thomas Hunt Morgan, professor of experimental zoology in Columbia University. Princeton University Press, Princeton, 1925.

DER KUNSTLICHE ABORT. Von Professor Dr. G. Winter, em. Direktor der Univ. Frauenklinik in Königsberg. Verlag von Ferdinand Enke, Stuttgart, 1926.

EDGAR'S PRACTICE OF OBSTETRICS. Revised by Norris W. Vaux, clinical professor of obstetrics in the Jefferson Medical College, etc. Sixth edition. With 684 illustrations, including 5 colored plates and 38 figures printed in colors. P. Blakiston's Son and Co., Philadelphia, 1926.

INSTRUMENTELLE PERFORATION DES GRAVIDEN UTERUS und ihre Verhütung. Von Professor H. v. Peham, Vorstand der ersten Univ. Frauenklinik in Wien, und Privatdozent H. Katz, Assistent der ersten Univ. Frauenklinik in Wien. Verlag von Julius Springer, Wien, 1926.

BIOLOGIE UND PATHOLOGIE DES WEIBES. Herausgegeben von Professor Josef Halban in Wien und Professor Ludwig Seitz in Frankfurt a.M. Lieferungen 25 und 26. Urban und Schwarzenberg, Berlin und Wien, 1926.

LEHRBUCH DER STRAHLENTHERAPIE. Band III. Die Strahlentherapie in der inneren Medizin. Herausgegeben von Professor F. Gudzent in Berlin und Professor H. Holthusen in Hamburg. Mit 160 Abbildungen im Text und 6 farbigen Tafeln. Urban und Schwarzenberg, Berlin und Wien, 1926.

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## The American Gynecological Society 1876-1926

Semicentennial Meeting and Anniversary Dinner\*

Stockbridge, Mass.

May 20, 21, and 22, 1926

### Original Communications

#### ENDOMETRIOSIS OF THE SAC OF A RIGHT INGUINAL HER- NIA, ASSOCIATED WITH A PELVIC PERITONEAL ENDOMETRIOSIS AND AN ENDOMETRIAL CYST OF THE OVARY†

By JOHN A. SAMPSON, M.D., ALBANY, N. Y.

*(From the Gynecological and Pathological Departments of the Albany Hospital and the Albany Medical College)*

IN RECENT years we have acquired many interesting facts, near facts and fancies in regard to the structure, activity and origin of benign ectopic endometrial tissue. We have learned that this tissue presents the same variations in structure as the mucosa lining the uterine cavity and that it is often governed by the same natural laws as the latter in its reaction to menstruation, pregnancy and the menopause. We have also learned that just as endometrial carcinoma invades the uterine wall so at times may benign endometrium do the same, the latter giving rise to a direct or primary uterine endometriosis, the so-called adenomyoma of mucosal origin or adenomyosis uteri interna.

The experimental work of Stilling,<sup>1</sup> Loeb<sup>2</sup> and others has shown that bits of uterine tissue of the lower animals may be transplanted to other

\*The addresses delivered at the Anniversary Dinner will be published in the special volume of the Society Transactions.

†Presented at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 22, 1926.

parts of the body of the same animal and there grow. The incidence of endometrial tissue in the scar of the abdominal incision after cesarean section and other pelvic operations in which it was possible to have contaminated the abdominal wound with fragments of endometrial or tubal tissue indicates or at least suggests, that under favorable circumstances this tissue may be unintentionally but successfully transplanted by the surgeon in human beings.

The experimental work of Jacobson<sup>3</sup> and others, especially the work of the former on monkeys, demonstrates that bits of uterine mucosa scattered in the pelvic cavities of these animals may give rise to peritoneal implantations of this tissue, resembling the lesions of peritoneal endometriosis in women. We know that fragments of endometrial tissue sometimes escape into the peritoneal cavity with a back flow of blood through the tubes from the uterine cavity during menstruation, from the rupture or perforation of an endometrial cyst of the ovary, and possibly from the menstrual reaction of endometrial tissue on the peritoneal surface of the various pelvic organs and structures. It would seem natural to believe that under favorable circumstances this endometrial tissue might become implanted on the peritoneum and there grow giving rise to the endometrial tissue in the lesions of peritoneal endometriosis just as similar lesions arise in experimental peritoneal endometriosis in the lower animals and as cancer becomes implanted on the peritoneum in peritoneal carcinosis.

I have observed bits of endometrial tissue in the venous sinuses and possibly the lymphatics of the uterine wall in patients operated upon

Fig. 1.—Peritoneal endometriosis in the posterior culdesac obliterating the bottom of the culdesac by fusing the anterior wall of the rectum to the posterior wall of the cervix uteri (natural size, from colored sketch made at the operation). The patient was thirty-seven years old and single; the uterus was retroflexed, both tubes were patent, and the induration in the culdesac, caused by endometriosis, was easily detected prior to the operation. A similar lesion in a hernia sac might constrict or occlude the lumen of its neck, as shown in Fig. 6.

Fig. 2.—Peritoneal endometriosis about subserous leiomyomas in the anterior wall of the uterus (natural size). Adhesions resulting from the peritoneal reaction are present and a hematoma, possibly of endometrial origin, has developed in these. The patient, aged forty-six years, has a multinodular myomatous uterus. An extensive peritoneal endometriosis was present with lesions in the right ovary, on the posterior and anterior surfaces of the uterus and in the posterior culdesac. (See Figs. 7 to 12 inclusive.) Both tubes appeared normal and patent. The hematomas in the hernia sac shown in Fig. 6 might have had an origin similar to the one in this illustration.

Fig. 3.—Under surface of the right ovary (Fig. 14) showing pigmentation apparently due to the incomplete absorption of blood (natural size). For the histology of this lesion see Fig. 16. Endometrial tissue was not found in the ovary.

Fig. 4.—Appearance of the peritoneal lesions of the anterior culdesac (natural size), Fig. 13. The pigmentation is in part due to the incomplete absorption of blood (see Fig. 17). Endometrial tissue was found in some of these lesions (see Figs. 17 and 20).

Fig. 5.—Appearance of the peritoneal lesion in the posterior culdesac (natural size) Fig. 14. It apparently represents a later stage of the process shown in Fig. 4. For its histologic structure see Fig. 22.

Fig. 6.—Endometriosis in a hernia sac (natural size). The entire sac including its neck and part of the intraabdominal portion of the round ligament were removed in one piece. The sac has been opened down to its neck. The abdominal opening *B* is constricted by the peritoneal endometriosis in this situation, similar to the condition shown in Fig. 1. The "arrow" indicates the course of the lumen of the neck of the sac which was obliterated (or nearly so) by the reaction associated with endometrial tissue in its walls (Figs. 25 to 30). Two pedunculated hematomas (*h*) apparently arising in adhesions are present and are possibly of endometrial origin (Figs. 31 to 33), as was the one shown in Fig. 2. The endometrial lesions in the sac (including its neck) are similar to those shown in Figs. 1 and 2.

during the menstrual period. Realizing the activity of this tissue and the fact that it may grow when transplanted in favorable soil we believe that possibly metastasis may occur through these channels. There are then many indications that the invasion and dissemination of benign endometrial tissue at times follows the same channels as carcinoma and chorioepithelioma.

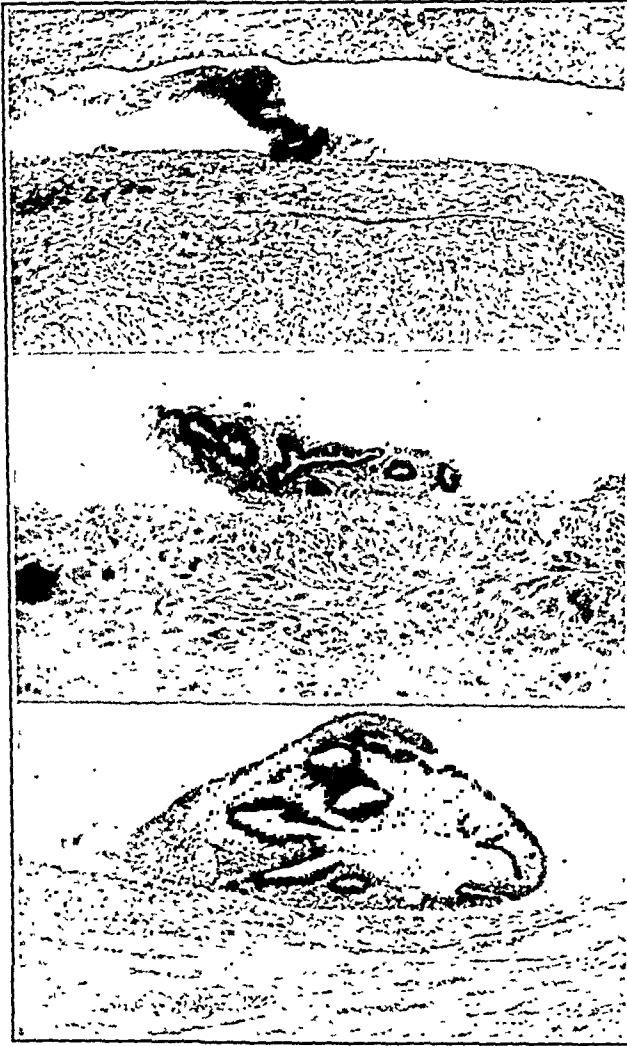


Fig. 7.—Three photomicrographs (x 60) of implantation-like lesions of endometrial tissue growing upon the surface of the right ovary, tube, and upon adhesions (case shown in Fig. 2). Their histologic structure is identical with that of the uterine mucosa. Do they represent an implantation of endometrial tissue or a metaplasia of the peritoneal mesothelium? I believe the former.

Pelvic peritoneal endometriosis therefore represents but one phase of heterotopic or disseminated endometrial tissue just as peritoneal carcinoma secondary to cancer of the pelvic organs, represents only one phase of heterotopic or disseminated cancer. Peritoneal endometriosis may be defined as implantation-like peritoneal lesions developing in women during their menstrual life and usually occurring in situations easily reached by material escaping into the peritoneal cavity from the tubes, ovaries or other pelvic structures. These lesions are characterized by

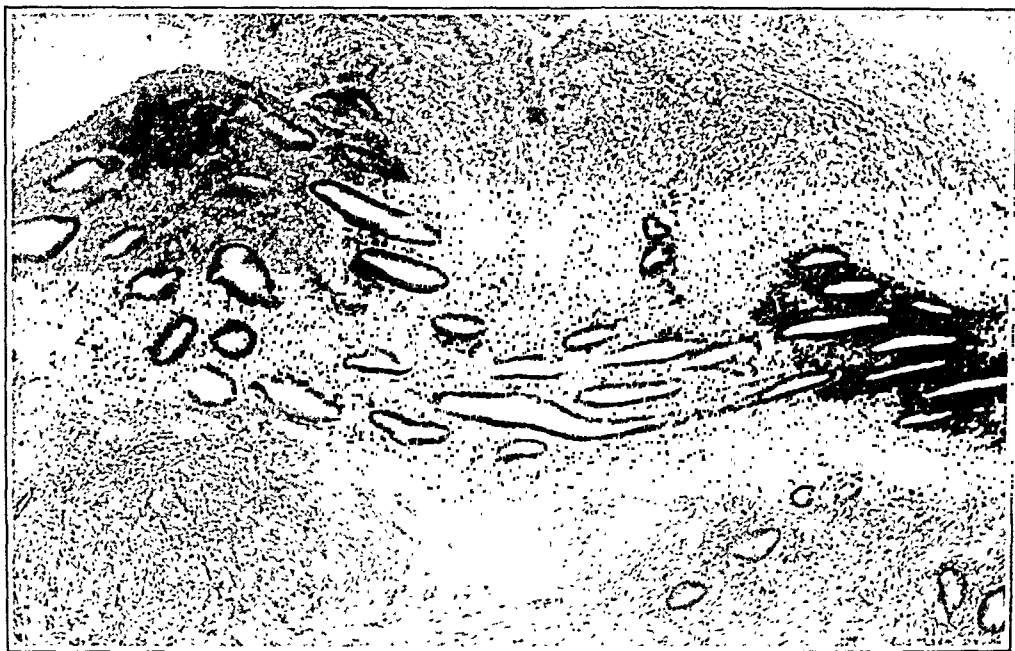


Fig. 8.—Photomicrograph (x 60) of endometrial tissue apparently invading the right ovary (case shown in Fig. 2). The condition present has arisen from two processes: one is the actual invasion of the ovary by the endometrial tissue, and the second, and probably the more active one, is the growth of the tissues of the ovary over the endometrial tissue upon its surface, thus enveloping it.

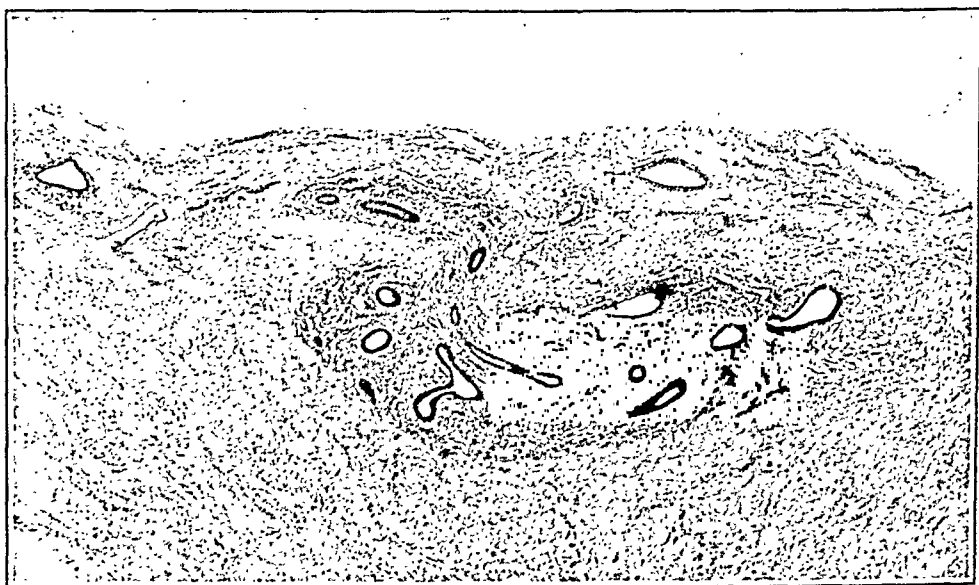


Fig. 9.—Photomicrograph (x 25) of endometrial tissue in the posterior uterine wall near its peritoneal surface (case shown in Fig. 2). As in the lesion shown in Fig. 8, the present condition probably arose from endometrial tissue deposited or developing upon the posterior surface of the uterus and the subsequent invasion of that organ by it and also the growth of the tissues of the uterus over it.

the well-known results of peritoneal irritation such as granulation and scar tissue, adhesions and various peritoneal inclusions and in addition by the presence of endometrial tissue either on the surface of or embedded in these lesions, bearing the same relation to them as does cancer in peritoneal carcinosis and like the latter at times invading underlying structures.

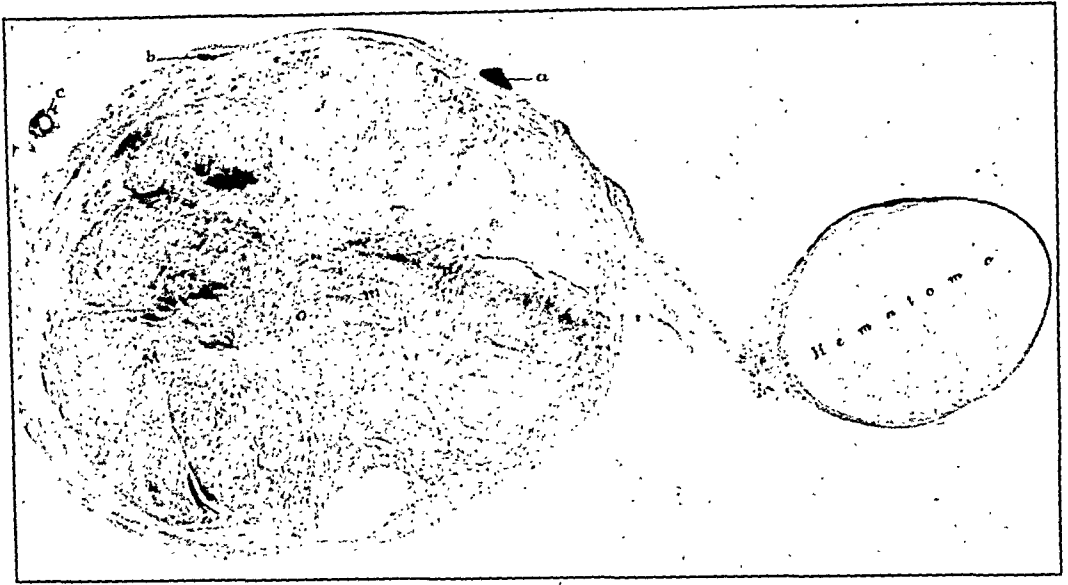


Fig. 10.—Photomicrograph (x 5) of a section through one of the subserous leiomyomas covered with adhesions and the hematoma in these adhesions (Fig. 2). Implantation-like lesions of endometrial tissue are present upon the surface of and imbedded in the adhesions; *a* (see Fig. 7), *b* (see Fig. 11), and *c* (see Fig. 12). The hematoma is lined by low to cuboidal epithelium-like cells and its contents consist of blood and phagocytic cells containing blood pigment. It is impossible definitely to state its origin. It might be an endometrial hematoma, and may have arisen from the accumulation of menstrual blood in a cavity similar to that shown in Fig. 11 or it might be a hemorrhagic peritoneal cyst. The hematomas shown in Fig. 6 might have had a similar origin.

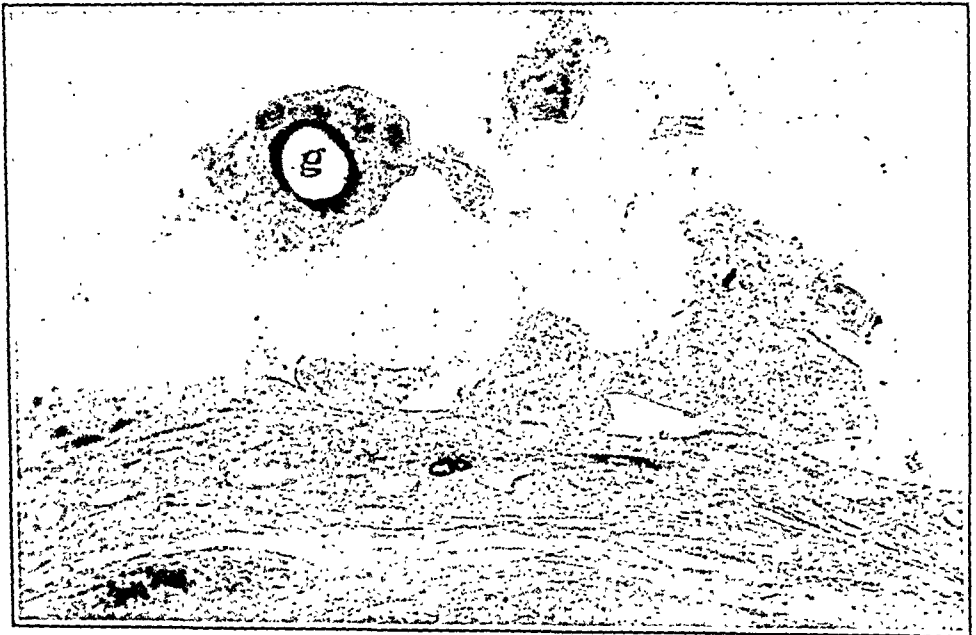


Fig. 11.—Photomicrograph (x 25) of the adhesions about the subserous leiomyoma shown in Fig. 11 (c). The adhesions are similar to those resulting from other peritoneal irritants and, in addition, a dilated gland-like structure (*g*) is present in the tip of one of the adhesions. Its histology is similar to that of a dilated uterine gland. It is lined by cuboidal epithelium-like cells with hemorrhage into the stroma about them. This stroma resembles atypical endometrial stroma. Should the blood about the dilated gland rupture into its lumen (as well it might) a hematoma would develop similar to those shown in Figs. 2 and 10 and Figs. 6 and 31.



The study of the distribution of the lesions of early pelvic peritoneal endometriosis at the time of operation demonstrates that they apparently consist of material escaping from the tubes or ovaries into the peritoneal

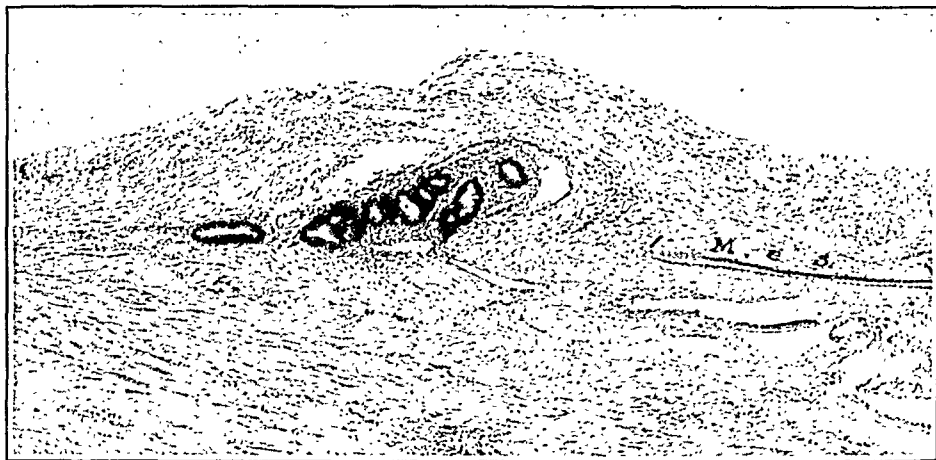


Fig. 12.—Photomicrograph (x 60) of adhesions about the subserous leiomyoma shown in Fig. 11 (b). Endometrial tissue is shown imbedded in the adhesions and protruding into a space lined by flattened cells, possibly a lymphatic, but more likely a dilated venous capillary. A definite inclusion of the peritoneal mesothelium is shown at *Mes*.

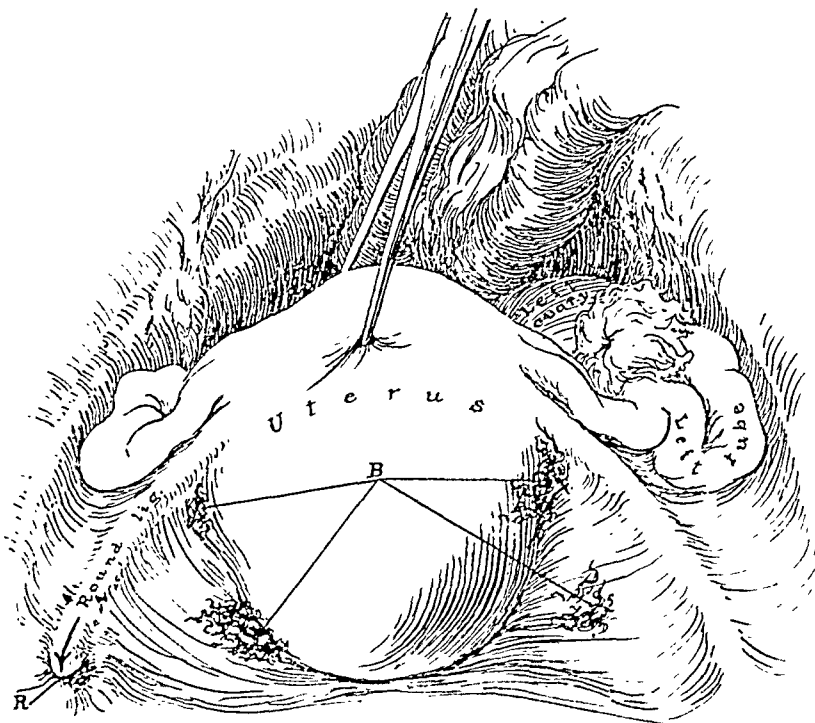


Fig. 13.—Peritoneal endometriosis associated with an endometrial cyst of the left ovary and an inguinal hernia. View of the pelvic contents showing the distribution of the lesions in the anterior culdesac (x  $\frac{3}{4}$ ). Pigmented scars (*B*) are present in the normal depressions of the culdesac and also in the peritoneum about the abdominal opening of the hernia (*R*). The gross appearance of one of the peritoneal scars is shown in Fig. 4 and its histologic structure in Figs. 17 and 20.

cavity and the local reaction against the same. Four possible sources of this "material" suggest themselves.

1. Bacterial infection. The histologic study of the lesions of pelvic peritonitis convinces me that this is not a cause. Furthermore, one of

the outstanding features of patients with peritoneal endometriosis is that the tubes are usually patent. It would seem that salpingitis occurring in the first half of the menstrual life of women lessens the incidence of peritoneal endometriosis in later years.

2. Ovulation permitting fragments of ovarian tissue to escape into the pelvis. I believe that possibly this tissue may at times become implanted on the peritoneum and there grow but I doubt its ability to form tissue with the structure of the uterine mucosa.

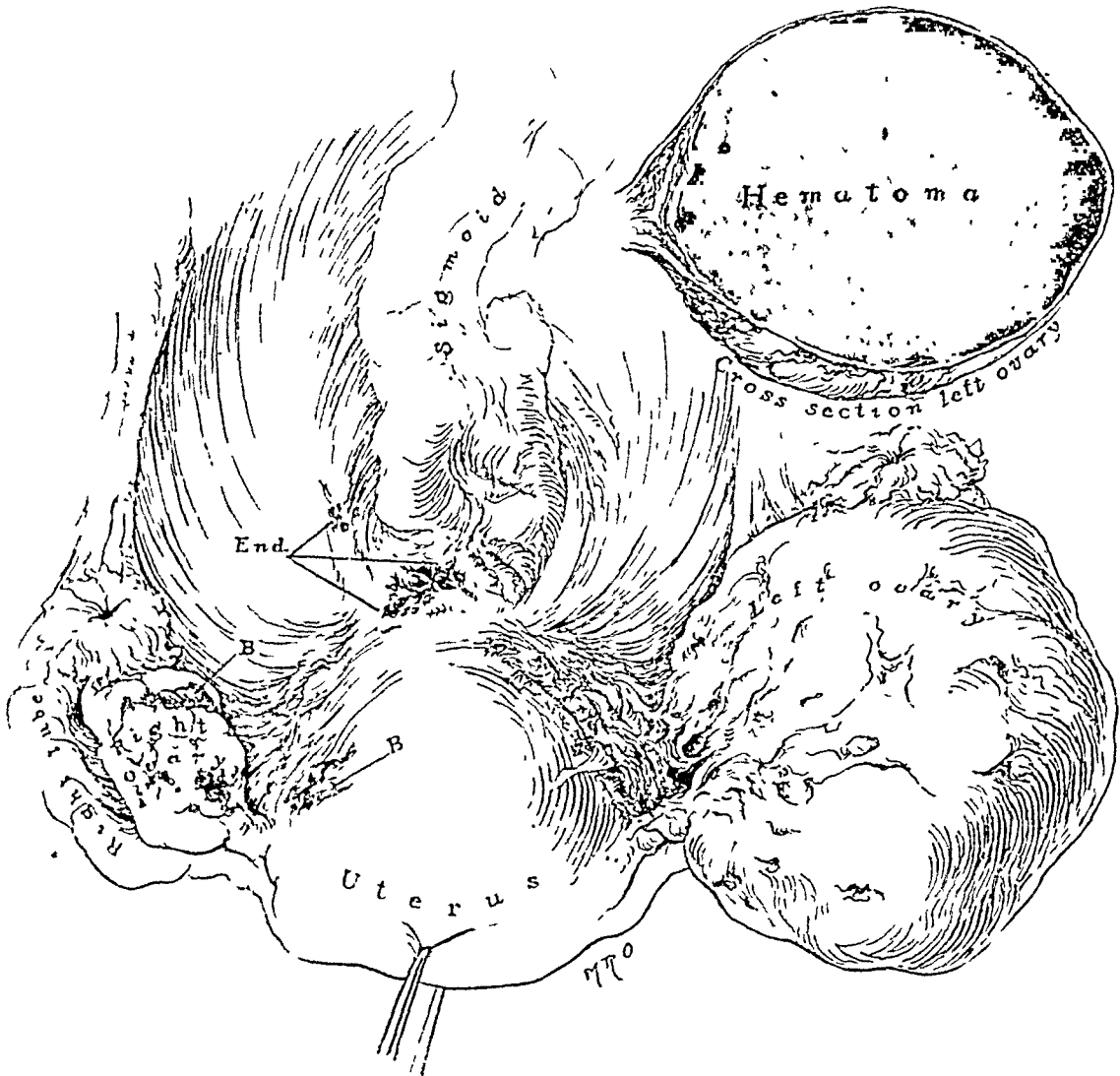


Fig. 11.—View of the pelvic contents showing the distribution of the lesions in the posterior culdesac ( $\times 4_1$ ) same case as Fig. 13. The cystic left ovary, which was adherent by its under and lateral surfaces to the posterior layer of the left broad ligament, has been freed and lifted out of the pelvic cavity. The uterus is drawn upward and forward. The left ovary is also shown in cross section. For the histologic structure of the walls of the endometrial cyst or hematoma of the left ovary see Figs. 15, 18, and 19. Recent-appearing pigmented lesions are present upon the under surface of the right ovary and upon the adjacent posterior surface of the uterus (*B-B*). Older lesions are present in the bottom of the culdesac and on the right uterosal ligament (*End.*). The gross appearance of the lesions upon the right ovary and in the culdesac are shown in Figs. 3 and 5, and their histologic structure in Figs. 16 and 22. The distribution and character of the peritoneal lesions in this case indicates or at least suggests that they represent the local reaction to blood escaping into the pelvis either from the perforation of the endometrial cyst of the left ovary or from the tubes (which appear normal and patent) or from both of these sources.

3. The menstrual reaction of endometrial tissue on the surface of the ovary and the rupture or perforation of an endometrial cyst or hematoma of the ovary. A study of those cases has convinced me that peritoneal endometriosis does arise from this source but as peritoneal lesions may be present without any demonstrable endometrial tissue in the ovaries we must conclude that the latter cannot be the only cause of peritoneal endometriosis. We, therefore, must look for an additional means by which menstrual blood may gain access to the peritoneal cavity.

4. Menstrual blood escaping through the tubes as a back flow from the uterine cavity and from the tubal mucosa. In 257 cases of peritoneal endometriosis, encountered the last four years, both tubes appeared to be patent in 250, a unilateral hematosalpinx was present in one (other tube patent), bilateral hematosalpinx in four and bilateral pyosalpinx in two. Patent tubes apparently increase the incidence of peritoneal endometriosis and possibly the relatively large number of patients with hematosalpinx (five) may be of some significance. In all six cases with occlusion of both tubes the peritoneal lesions might have been present before the tubes were closed. A translation of these findings might read that during the menstrual life of women some substance escapes through the tubes into the peritoneal cavity which plays an important rôle in the etiology of pelvic peritoneal endometriosis, including the development of endometrial tissue in the ovaries. We have noted that peritoneal endometriosis apparently arises from the escape of the contents of endometrial cysts of the ovary into the pelvic cavity and from the menstrual reaction of endometrial tissue on the surface of that organ. Therefore it would seem that menstrual blood from any source might be a cause of pelvic peritoneal endometriosis. The distribution of the pelvic peritoneal lesions in the early cases is often such as to indicate their origin from material escaping through the tubes as well shown in the case reported

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Fig. 15.—Colored photomicrograph (x 60) of a portion of the wall of the endometrial cyst of the left ovary (Fig. 14). In the right half of the photomicrograph the epithelial lining is still present while in the left half it is absent. The pigmented phagocytic cells, which constitute a large portion of the lining of the cyst, represent the attempt of the ovarian tissue to take up (absorb) the blood (menstrual) in its tissues and cavity. In other portions of the cyst wall typical uterine mucosa was present (Figs. 18 and 19).

Fig. 16.—Colored photomicrograph (x 60) of the pigmented lesion upon the right ovary (Figs. 3 and 14). Granulation tissue containing pigmented phagocytic cells, similar to those shown in Fig. 15, has developed upon the surface of the ovary and has arched over and included portions of the surface epithelium (S. S.). I believe it represents a reaction to blood deposited upon the surface of the ovary and the incomplete absorption of this blood. A similar reaction (without the blood pigment) may arise from any irritant, and, should a foreign body, such as a piece of silk thread, a bit of cancer or endometrial tissue, lodge upon the surface of the ovary, this foreign body might be enveloped by granulation tissue just as the surface epithelium is in this illustration. Endometrial tissue was not found in the lesions of this ovary.

Fig. 17.—Colored photomicrograph (x 60) of the pigmented peritoneal lesion shown in Fig. 4 and in Fig. 13. The vascular, newly-formed connective tissue upon the surface contains phagocytic pigmented cells similar to those shown in the two preceding illustrations. I believe it represents a later stage of the condition shown in Fig. 16. Deeper in the uterine wall is a space containing and lined by tissue of the structure of the uterine mucosa. A small amount of blood is present in this "endometrial cavity." Should a large amount accumulate a hematoma would be formed as in Fig. 21. For photomicrographs suggesting the development of this lesion see Fig. 20.

by Davis at this meeting. Phagocytic cells containing blood pigment are often present in the peritoneal reactions associated with peritoneal endometriosis. The distribution of these phagocytic cells often indicates that the blood did not necessarily arise from menstruation of the endometrial tissue in these lesions. Blood is occasionally observed escaping from the tubes of patients operated upon during their menstrual period. Why should not this blood be considered an equally efficient factor in the etiology of pelvic peritoneal endometriosis as that arising from endometrial tissue in the ovary?

From this indirect and direct evidence I have concluded that menstrual blood escaping into the peritoneal cavity by any route, as through the tubes, from the perforation of an endometrial cyst of the ovary or from the menstrual reaction of endometrial tissue on the peritoneal surface of any pelvic structure, may at least be a frequent cause of the lesions in pelvic peritoneal endometriosis. Also, the endometrial tissue in these lesions results either from the implantation and growth of frag-

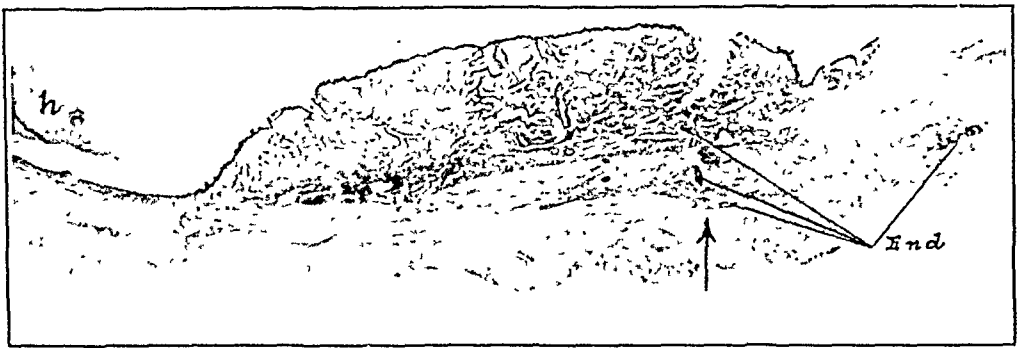


Fig. 18.—Photomicrograph (x 10) of a portion of the wall of the endometrial cyst of the left ovary, which was firmly adherent to the posterior layer of the broad ligament. A patch of typical "uterine mucosa" (see Fig. 19) is present, the surface epithelium of which is continuous with the epithelium lining the less typical endometrial portions of the cyst. The wall of the cyst is relatively thick in the right half of the section due to portions of the broad ligament which are fused with it and which were removed with the cyst. Glands (*End.*) of endometrial type are present in this tissue and these can be traced through the wall of the cyst into the uterine mucosa lining its cavity (see arrow and also Fig. 19). The fusion of this portion of the cyst wall with the posterior layer of the broad ligament must have arisen from the reaction either to the contents of the cyst escaping through a perforation of the latter or to an irritant from another source causing or associated with the endometriosis in this situation.

ments of endometrial tissue, which we know are sometimes present in menstrual blood, or else in some magical and mysterious way menstrual blood converts the peritoneum into tissue with the structure of the uterine mucosa. The endometrial lesions of peritoneal endometriosis do not arise in all portions of the peritoneum soiled by menstrual blood as indicated by scar-like areas containing blood pigment, some with and others without demonstrable endometrial tissue. We must therefore conclude that if the endometrium in these lesions arises from the stimulation of peritoneal mesothelium by menstrual blood, either there must be a solid element in this blood which acts as a specific irritant to the mesothelium, or else there are scattered throughout the pelvic peritoneum

areas of potential müllerian tissue which under the specific action of menstrual blood develop into endometrial tissue. The lesions are most frequently found in the dependent portions of the pelvis and in its natural folds and pockets. Their distribution, therefore, would seem to depend more upon gravity and other physical factors than upon the presence of areas of dormant endometrial tissue scattered throughout the pelvic peritoneum and in the serosa covering the various organs and structures which may be in the pelvis.

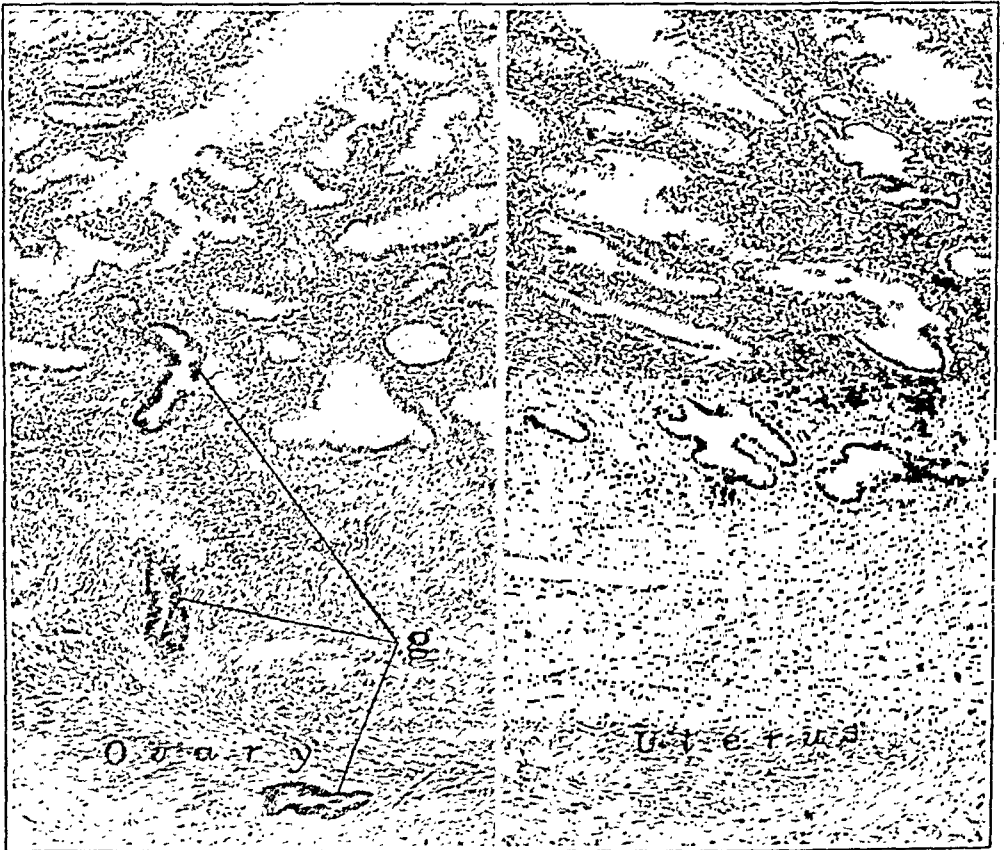


Fig. 19.—Two photomicrographs (x 60) comparing the "uterine mucosa" of the ovarian cyst with that lining the uterine cavity. The histologic structure of the two are identical. The photomicrograph (to the left) is of the portion of cyst wall indicated by the arrow in Fig. 18. From the study of other sections of this area the gland *g* could be traced through the cyst wall into the "uterine mucosa" lining its cavity. This suggests that the endometrial tissue in the ovary might have primarily arisen from similar tissue developing upon its surface. The ovarian cyst or hematoma could have arisen from the retention of menstrual blood in endometrial tissue in the ovary like that in the uterine wall (Fig. 17), just as the hematoma in the wall of the cervix shown in Fig. 21 probably arose.

Menstrual blood undoubtedly irritates the peritoneum causing inflammatory exudation, granulation tissue, adhesions and peritoneal inclusions. These would be the very conditions which would favor the retention and growth of any epithelium or other tissue present in this blood, just as similar peritoneal reactions make possible the retention and growth of fragments of cancer escaping into the peritoneal cavity. While menstrual blood may be very injurious to the mesothelium the

fragments of uterine tissue in it might remain alive for a longer time, being more accustomed to its presence.

I fully appreciate the fact that many interesting tubular structures and cavities lined by epithelium-like cells, similar to those of the uterine mucosa, may arise from the inclusion of peritoneal mesothelium by granulation tissue as a result of peritoneal irritation, but I am not convinced that these structures ever develop into typical endometrium. On the other hand, I do believe that fragments of endometrial tissue escaping into the peritoneal cavity at times become implanted on the surface of the peritoneum much in the manner of carcinoma, and as experi-

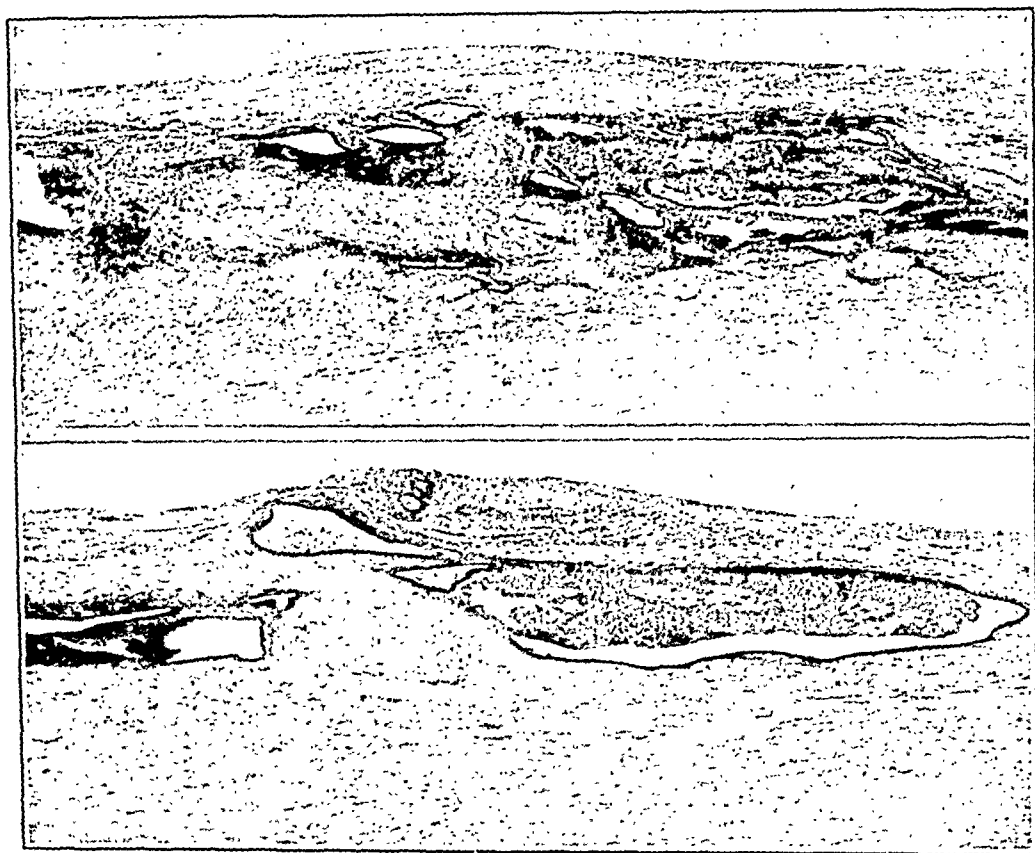


Fig. 20.—Two photomicrographs (x 25) of endometriosis of the anterior wall of the uterus from the same block of tissue as the section shown in Fig. 17 (the upper photomicrograph is from the same section as Fig. 17). The histologic structure of the endometrial tissue in this lesion is identical with that shown in Fig. 19. The method of the development of the lesion is not indicated in the upper photomicrograph. On the other hand it is suggested in the lower one. The first impression is that it might have invaded the uterine wall in an oblique direction from its peritoneal surface. I believe that this is only partly true. The larger space containing endometrial tissue is covered mainly by vascular, newly-formed . . . . . I believe that this represents the growth of the tissues of the uterus . . . . . tissue developing upon its peritoneal surface, thus enveloping it. Should menstrual blood accumulate in these endometrial cavities, a hematoma would arise similar to the one shown in Fig. 21 and also similar to the ovarian hematoma or cyst.

mentally accomplished by Jacobson in lower animals. Further studies will prove the truth or fallacy of these observations and deductions. I also believe that endometrial tissue in the ovary may arise in like manner, but am not confident that it accounts for all instances of this tissue in that organ.

Peritoneal endometriosis may occur with and without demonstrable endometrial tissue in the ovaries. If the latter is present it may be small in amount and similar to the peritoneal lesions (Figs. 7 and 8), or an endometrial cyst (Fig. 14) may be present. The peritoneal lesions may be few, small and superficial or extensive. In some instances there may be a deep invasion of underlying structures. The histology of the peritoneal changes in these lesions probably represents the reaction of the latter to two irritants, one the menstrual blood and the other the endometrial tissue. That due to the former is similar to that found in perit-



Fig. 21.—Photomicrograph (x 10) of an endometrial hematoma in the posterior wall of the supravaginal portion of the cervix (another case). This was associated with an extensive peritoneal endometriosis in the posterior culdesac involving the supravaginal portion of the cervix and the rectosigmoid, and an endometrial cyst of the right ovary. The histology of the lining of this hematoma is identical with that of the endometrial cyst of the ovary reported in this paper, normal-appearing "uterine mucosa" to the right, and the greater portion of the hematoma lined by epithelium with little or no underlying endometrial stroma, and by phagocytic pigmented cells. This hematoma or "cyst" has obviously arisen from the accumulation of menstrual blood in an endometrial cavity. The endometrial ovarian cyst described in this paper might have had a similar origin.

onitis of infectious and other origin. In addition, blood pigment is often present due to the incomplete absorption of the menstrual blood primarily causing the lesions and also from the menstrual reaction of the endometrial tissue in them. The reaction of the host toward the acquired endometrial tissue is similar to that of the tissues of the uterine wall to the endometrial tissue invading it in a direct or primary uterine endometriosis.

It is obvious that many interesting peritoneal lesions may be encountered in patients with peritoneal endometriosis, such as typical and atypical uterine mucosa on the serosa (Figs. 7 and 10), inclusions of endometrial tissue in the peritoneal reactions (Fig. 12), the invasion of underlying structures by endometrial tissue (Fig. 9) and hematomas from the retention of menstrual blood in endometrial cavities (Fig. 21). These endometrial hematomas occur more frequently and reach a larger size in the ovaries (Fig. 14) than in other situations.

Of particular interest in connection with the case about to be reported is the presence of endometrial tissue in peritoneal adhesions especially those of the waving fringe-like type (Figs. 10 and 27). The endometrial tissue may be on the surface of or embedded in any portion of the adhesion (sometimes in the very tip) just as cancer is found in the adhesions

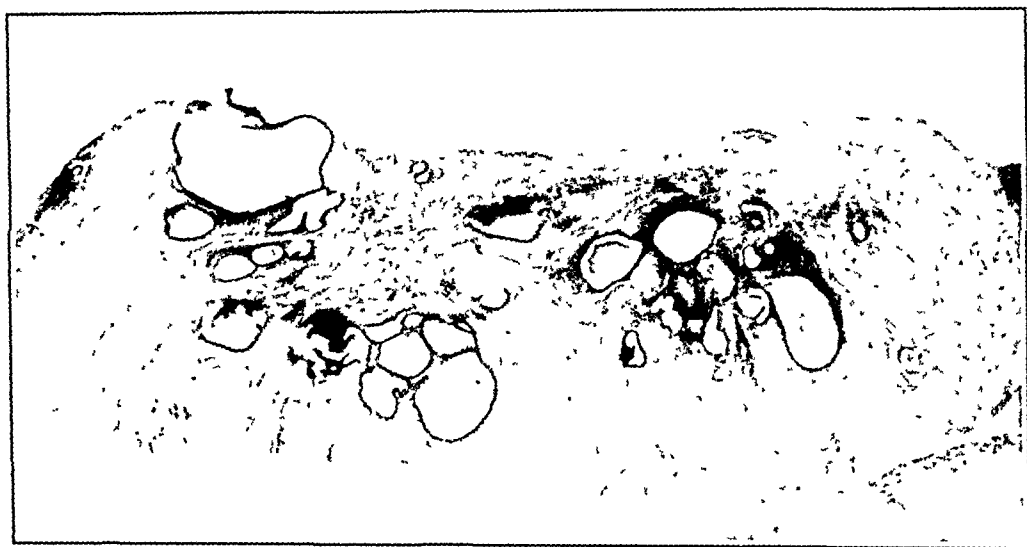


Fig. 22 —Photomicrograph (x 10) of the nodule of endometriosis excised from the posterior culdesac shown in Figs. 5 and 14.

of peritoneal carcinosis. Hematomas from the retention of menstrual blood might arise in the endometrial tissue of these adhesions just as they arise in the uterine wall, ovary, or any other organ or structure invaded by this tissue. The simplest form of an endometrial cavity containing menstrual blood is a dilated gland and the more complex and the more readily recognized ones are those lined wholly or in part by typical endometrial tissue (Fig. 21). It might seem that less resistance would be offered to the accumulation of blood in endometrial tissue in adhesions than in the firmer structure of the uterine wall and therefore might be the more easily distended.

#### INGUINAL ENDOMETRIOSIS

Inguinal endometriosis may be defined as the presence of endometrial tissue in the groin. It has also been reported as adenomyoma of the groin and adenomyoma of the round ligament.



Various theories may be considered for the explanation of the origin of the endometrial tissue in this situation and these must be modified to meet the conditions found in individual cases.

1. The congenital theory. The condition arises in developmentally misplaced portions of the müllerian or wolffian systems.

2. The metaplasia theory. It is due to a metaplasia of the mesothelial lining of the processus vaginalis peritonei or of the endothelial lining of dilated vessels.

3. A direct extension along the round ligament from a peritoneal endometriosis about the abdominal inguinal ring.

4. Metastatic through lymphatics or veins secondary to a peritoneal endometriosis invading the vessels accompanying the round ligament or from a primary uterine



Fig. 23.—Photomicrograph (x 10) of a cross section of the right tube showing endometriosis in its lateral wall. The invasion of the tube by endometrial tissue is in large part accomplished by the "buckling in" of the tubal serosa and the local hyperplasia resulting from its reaction to the endometrial tissue.

endometriosis, or even from endometrial tissue escaping into the uterine vessels during menstruation.

5. Implantations in a hernia sac, or if we accept the metaplasia theory it is due to the reaction of the peritoneum of the sac to menstrual blood escaping into it.

In a previous communication<sup>4</sup> I reported three cases of inguinal endometriosis.

In the first case the endometriosis was situated just below the external abdominal ring and the round ligament was not observed during the operation. An extensive pelvic peritoneal endometriosis was present with invasion of the uterine end of the round ligament and the structures about it, on the same side as the endometrial tissue in the groin.

In the second case the mass of tissue which included the glands was adherent to the side of the terminal portion of the round ligament but I was unable to demonstrate actual invasion of that structure. A pelvic peritoneal endometriosis was also present in this case with an invasion of the tissue between the layers of the broad ligament below the uterine end of the round ligament of the same side as the lesion in the groin. I inferred that the endometrial tissue in the groin in both of these cases might have been secondary to that in the pelvis by metastasis through lymph vessels or veins accompanying the round ligament.

In the third case a femoral hernia was present and the tissue containing the endometrial elements was densely adherent to the anterior surface of the femoral vein just below the sac of the hernia. I was unable to find any endometrial tissue in the hernia sac nor did I determine the exact relation between the sac and the endometriosis. (I wish that I had had my present knowledge of the subject at that time.) The pelvic organs were inspected but not removed. Gross evidence of pelvic



Fig. 21.—Photomicrograph (x 25) of the endometrial tissue shown in Fig. 23. Its histologic structure is identical with that shown in Fig. 19. The endometrial tissue is "dipping" into the wall of the tube, and the tissues of the latter have grown over it.

peritoneal endometriosis was not observed. The uterus was slightly enlarged with what appeared to be a small leiomyoma presenting between the layers of the broad ligament of the same side as the endometrial tissue in the groin. In the discussion of the etiology of the ectopic endometrial tissue in this instance I considered the possibility of metastasis through lymph vessels or veins from a primary uterine endometriosis or from endometrial tissue escaping into uterine veins during menstruation.

The case about to be reported was briefly mentioned in a footnote of this article.<sup>4</sup>

#### REPORT OF CASE:

Endometriosis of the sac of a right inguinal hernia associated with pelvic peritoneal endometriosis. Peritoneal lesions in the posterior and anterior culdesac, in the wall of the right tube, and in the hernia sac including its neck (the lumen of the

latter having been occluded or nearly so, by the endometriosis in its walls). Endometrial cyst of the left ovary.

The patient, unmarried and aged forty-four, complained of a right inguinal hernia. Menstruation was regular, moderate in amount until the last two years when it had become quite profuse. Menstrual pain had not been a marked symptom. The patient stated that she had been more conscious of the hernia during her menstrual periods the last year. (This latter information was obtained after the operation when the exact nature of the lesion of the hernial sac had been ascertained.) The menstrual flow occurred from June 10 to June 16. The hernia had been noticed for two years and had been reducible until the last four months. Pelvic examination demonstrated that the uterus was slightly enlarged and retroverted with a nodular induration in the culdesac and an adherent "cystic" mass to the left of the uterus. The preoperative diagnosis was right inguinal hernia, probably containing omental



Fig. 25.—Photomicrograph (x 10) of a cross section of the neck of the hernia sac near the internal abdominal ring. The round ligament appears in cross section, and the lumen of the canal is situated just above it. A pigmented peritoneal lesion (B) containing "endometrial stroma" and phagocytic cells but no glands is present in the wall of the canal.

tissue, a myomatous uterus associated with endometriosis in the culdesac, and an endometrial cyst of the left ovary. The operation occurred at the Albany Hospital July 3, 1925. A median incision was first made. The uterus was found to be slightly enlarged, due to a small intramural leiomyoma in its anterior wall, retroverted and displaced to the right by an adherent cystic left ovary. Both tubes appeared patent and normal. The right ovary was of normal size and, except for pigmentation on its under surface, it appeared normal. Similar pigmented areas were also present in the dependent portions of the anterior culdesac, on the anterior surface of the uterus mesial to the round ligaments, on the anterior surface of the broad ligaments and in the vesicouterine fold of the peritoneum (Fig. 13). The peritoneum about the right internal abdominal ring was puckered and pigmented (Fig. 6). The left ovary was cystic, enlarged, and firmly adherent by its lateral and under surfaces to the posterior layer of the left broad ligament. The left ovary

was freed with difficulty and without rupturing its cyst by removing with it portions of the adherent posterior layer of the left broad ligament. On exposing the posterior culdesac (Fig. 14), an area of pigmentation was found on the posterior surface of the uterus near the attachment of the right broad ligament. There was marked induration in the culdesac just mesial to the uterine end of the right uterosacral ligament. This was also pigmented but differed in its appearance and consistency from the other pigmented areas just described. I believe that it represented an older lesion. A similar lesion was also present on the right uterosacral ligament and in the wall of the right tube near its fimbriated extremity. The appendix, left tube, ovary and uterus were removed. The pigmented portion of the right ovary was excised and also a portion of the right tube and the pigmented indurated tissue in the culdesac. The right round ligament including the peritoneum about the internal abdominal ring and the entire hernia sac were removed in one piece. The hernia

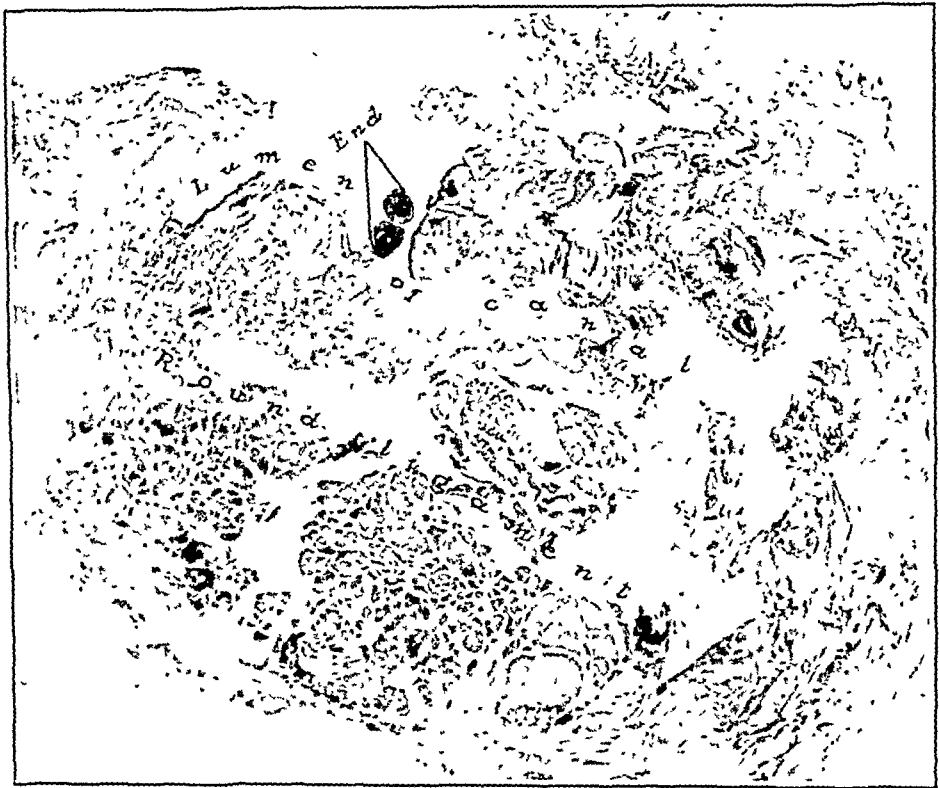


FIG. 26.—Photomicrograph (x 10) similar to the preceding one but at a lower level. The walls of the canal were torn in cutting the section. An endometrial polyp *End.* (see Fig. 27) developing in or attached to the tip of an adhesion lies in the lumen of the canal.

was repaired and the abdominal incision closed. The patient made a satisfactory convalescence.

*Pathologic Findings.*—The left ovary was enlarged (greatest diameter 6.5 cm.), its surface was smooth except over the area which had been attached to the posterior layer of the left broad ligament. On section it was found to have been almost entirely replaced by a hematoma with chocolate-like contents (Fig. 14). The lining of the walls of the hematoma presented the varied histologic structure so often found in endometrial cysts or hematomas, low to columnar epithelium with little or no underlying stroma similar to that of the uterine mucosa, pigmented phagocytic cells beneath the epithelium, phagocytic cells without an epithelial covering (Fig. 15) and scattered here and there areas of uterine mucosa with a structure identical with that of the endometrium of the accompanying uterus (Figs. 18 and 19). The

areas of uterine mucosa were most numerous in the portion of the cyst wall which had been attached to the broad ligament. Glands or tubules of the structure of the uterine mucosa were found on the outer surface of this portion of the cyst and these could be traced through its wall into the endometrial tissue lining it, thus suggesting that the endometrial tissue in the cyst had arisen from similar tissue developing or deposited on the surface of the ovary with its subsequent invasion of that organ and that the hematoma was created by the retention of menstrual blood in the endometrial cavity thus formed. The adhesions between the ovary and the broad ligament could have arisen either from the perforation of the cyst and the reaction to its escaped contents or from the reaction to the endometrial tissue developing on its surface.

The pigmentation on the surface of the right ovary was due to phagocytic cells in newly formed connective tissue on the surface of that organ, apparently representing an incomplete absorption of blood deposited there. Inclusions of the surface epithelium of the ovary were found in these lesions but no endometrial tissue (Fig. 16).

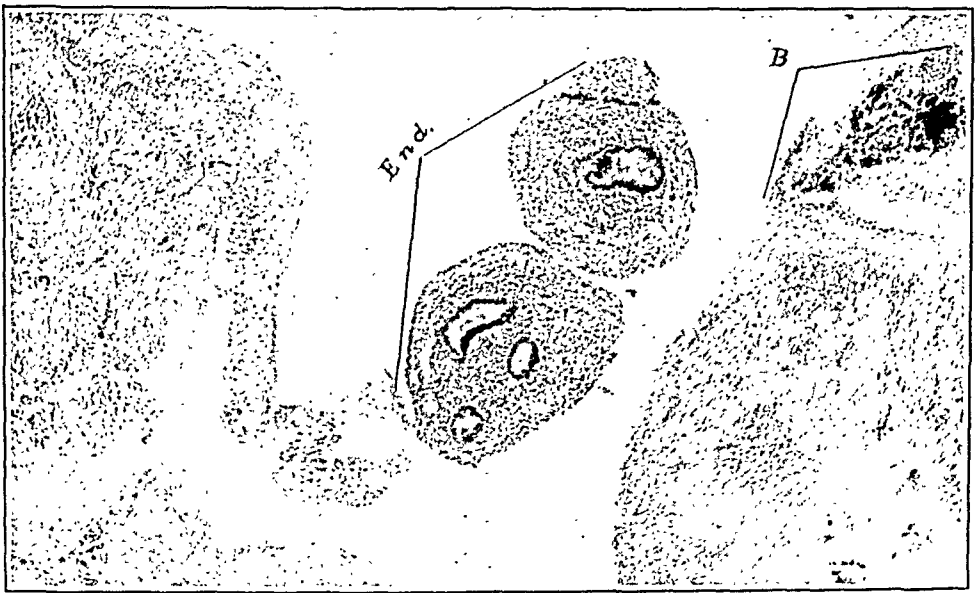


Fig. 27.—Photomicrograph (x 60) of the pedunculated endometrial polyp *End.* shown in Fig. 26. The endometrial tissue has developed in or has become attached to the tip of an adhesion, the latter forming the pedicle of the polyp. The polyp consists of typical uterine glands and stroma and strongly suggests an implantation. A pigmented peritoneal lesion is present at *B*.

The pigmented peritoneal lesions (Figs. 4 and 13) in the anterior culdesac presented a histologic picture similar to those of the right ovary except that they represented a later stage of the peritoneal reaction and typical endometrial tissue was found in some of these (Figs. 17 and 20). In one a definite endometrial cavity had developed without retention of menstrual blood. One could readily imagine that had menstrual blood accumulated in this cavity a hematoma would have resulted similar to that in the left ovary.

The endometriosis (Figs. 5, 14 and 22) in the posterior culdesac apparently represented an older lesion as shown by its being more circumscribed, less vascular, the increase in connective tissue about it and the relatively small number of phagocytic cells near its surface.

The uterine mucosa was normal and a typical intramural leiomyoma was present in the anterior wall.

The neck of the hernia sac was occluded or nearly so by the peritoneal reaction towards the endometriosis in this situation. The histologic structure of these lesions

was identical with that of the other peritoneal lesions and in addition two other very interesting conditions were present. One of these was an endometrial polyp with a long pedicle suggesting that endometrial tissue had developed or had been caught in the tip of an adhesion (Figs. 26 and 27). The endometrial tissue consisted of stroma and glands of the structure of the uterine mucosa. A polyp similar to this might have been the forerunner of the two pedunculated hematomas found in the hernia sac. The other lesion was a small mass of endometrium attached to the wall of the sac, which consisted of both stroma and glands (Fig. 28). The cellular elements of both of these stained poorly as though the tissue was necrotic or degenerating. On the other hand, healthy appearing endometrial tubules had apparently arisen from this tissue and had invaded the underlying structure. The condition strongly suggested that a fragment of uterine mucosa had become lodged in the neck of the sac and had encountered difficulty in becoming engrafted (Fig. 29).



Fig. 28.—Photomicrograph (x 10) similar to Fig. 26 but at a lower level. The lumen (L-L) of the canal is partially obliterated by an inflammatory reaction at X. An endometrial lesion (End.) is present on and is invading the wall of the canal. See also Fig. 29.

Adhesions were present in the hernia sac. Phagocytic cells and endometrial tissue (Figs. 6, 31 and 32) were found in its wall as in the peritoneal lesions in the pelvis. The most striking lesions in the sac were two pedunculated hematomas (Fig. 6). The larger hematoma consisted of a connective tissue sac lined by flattened cells and filled with blood. There was no clue found to indicate its etiology except that it might represent a later stage of the condition found in the smaller one. The latter also had a cellular lining, in places cast off into its cavity (possibly caused by the trauma of the operation). These cells were low to cuboidal, similar to those found lining certain portions of the endometrial ovarian cyst. The underlying tissue in places resembled endometrial stroma. The contents of the hematoma consisted of blood and pigmented phagocytic cells (Fig. 33) similar to that of the ovarian hematoma. It is possible that these hematomas (especially the smaller one) might have arisen from the accumulation of menstrual blood in endometrial tissue caught or

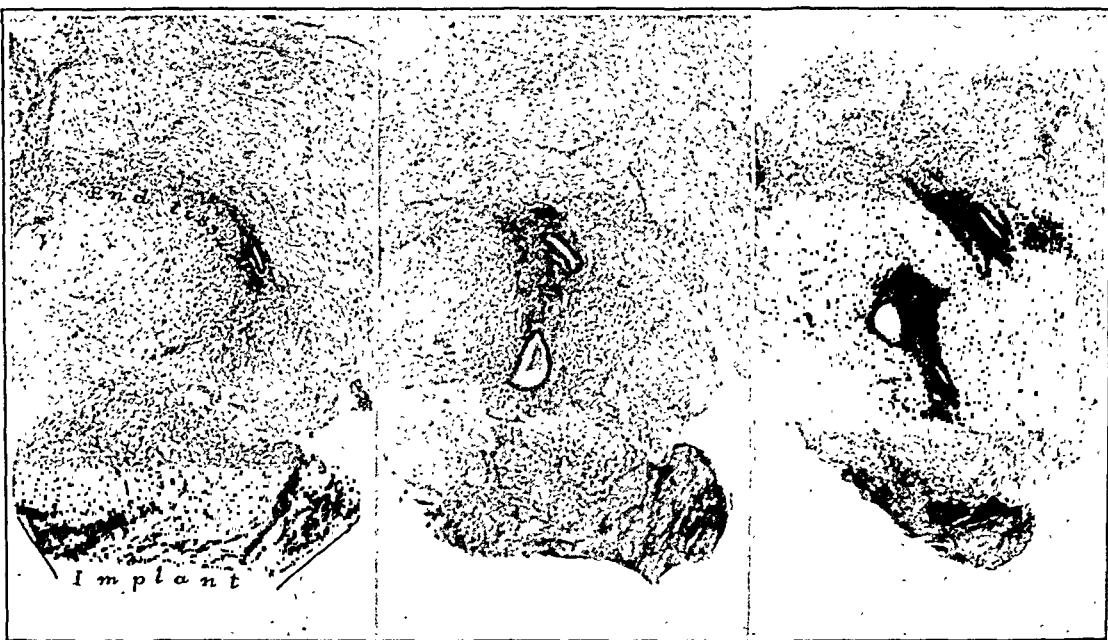


Fig. 29.—Three photomicrographs (x 60) of the endometrial tissue upon and invading the wall of the inguinal canal shown in Fig. 28. The lesion upon the surface consists of endometrial stroma and glands which stain poorly and appear to be partially necrotic. This portion suggests an endometrial implantation which had encountered difficulty in becoming established or is degenerating. Healthy-appearing endometrial tissue has invaded the wall of the canal and apparently came from a direct extension of that in the implant.

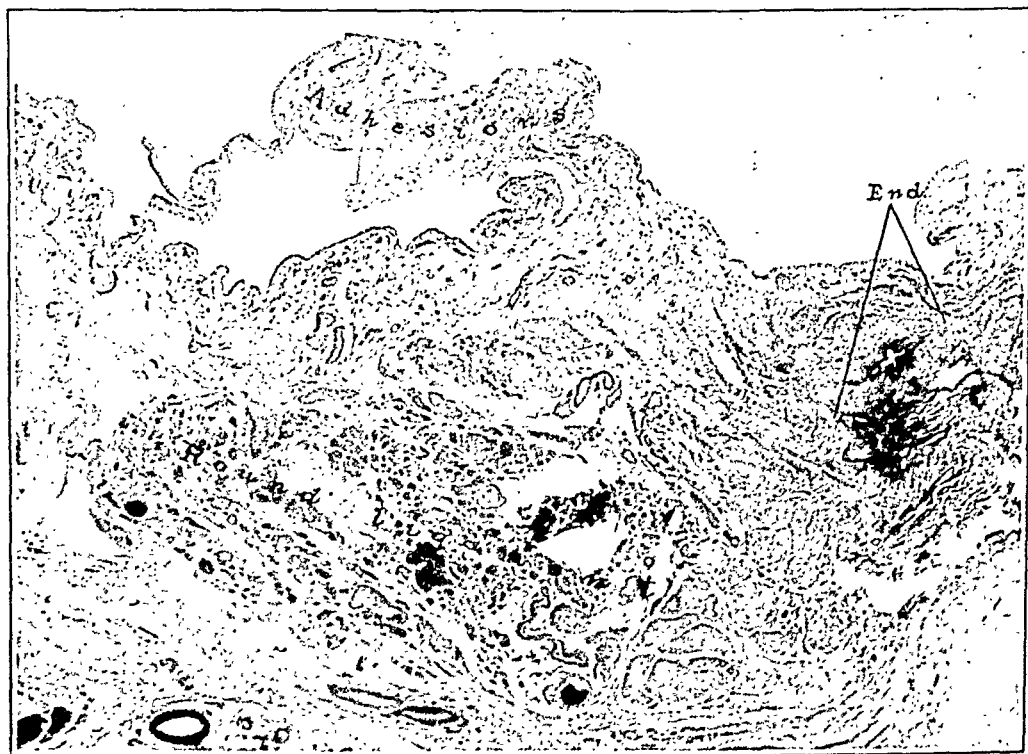


Fig. 30.—Photomicrograph (x 10) similar to Fig. 28 but at a lower level and within the hernia sac. Adhesions are present and an endometrial lesion (End.) is situated in the wall of the sac lateral to the round ligament.

developing in an adhesion as is occasionally encountered in peritoneal endometriosis (Figs. 10 and 11). The patient at times had worn a truss which may have traumatized and distorted these lesions.

#### ETIOLOGY OF THE ENDOMETRIAL LESIONS IN THIS CASE

The character and the distribution of the peritoneal lesions, found at the operation, indicated a peritoneal reaction (peritonitis) apparently due to the escape of blood or bloody fluid into the pelvic cavity (Figs. 13, 14, 16 and 17). The pigmentation of the lesions was due to the incomplete absorption of blood (Figs. 3, 4 and 5). Their histologic structure showed a peritoneal reaction with newly formed connective tissue (scars) containing phagocytic cells filled with blood pigment and also inclusions



Fig. 31.—Photomicrograph (x 8) of a section through the wall of the hernia sac and the smaller pedunculated hematoma shown in Fig. 6. The hematoma is partially lined by low to cuboidal epithelium-like cells (Fig. 33) and in a few areas an underlying tissue is present resembling endometrial stroma. The contents consist of blood and phagocytic cells containing blood pigment. The epithelial lining and contents of the hematoma are identical with that of portions of the endometrial cyst of the ovary. The histology of the lesion suggests that it could be of endometrial origin similar to the hematoma shown in Figs. 2 and 10, and that the hematoma is due to the accumulation of menstrual blood in an endometrial lesion. The endometrial tissue in the wall of the hernia sac is apparently deeply imbedded in it, and there is a hyperplasia of the tissue surrounding it. For possible explanation of the development of the endometrial lesion in this situation see Fig. 32.

of the surface epithelium of the ovary (Fig. 16) and of the peritoneal mesothelium. In addition histologically typical endometrial tissue was found in some of these scars (Figs. 17 and 20), some of which (those in the posterior culdesac) were evidently older than others, indicating that there had been at least two different and distinct attacks of peritonitis arising from the escape of some material into the peritoneal cavity.



The lesions occurred in natural depressions and pockets of the pelvis (Figs. 13 and 14) and therefore their distribution would seem to be dependent more upon gravity and other physical factors than scattered areas of dormant endometrial tissue. The left ovary, containing the endometrial cyst, was fused by its under and lateral surfaces to the posterior layer of the left broad ligament (Fig. 14). It was evident that this fusion was due either to the local reaction arising from the escape of the contents of the cyst into the peritoneal cavity through a rupture or perforation of the cyst or else a peritoneal irritant from another source had been responsible, both for the endometrial tissue of the ovarian cyst and the reaction about it.



Fig. 32.—Photomicrograph (x 8) of a section from the same block as the preceding one. The right half of the wall of the sac is thrown into folds which are held together by adhesions upon the surface. These adhesions consist of vascular, newly-formed connective tissue with clumps of phagocytic cells containing blood pigment. The endometrial tissue developed in the pockets between the folds of the sac. See also Fig. 31. The subsequent fusion of the folds, together with the adhesions upon the surface, caused the endometrial lesion shown in Fig. 31. Menstrual blood escaping into the hernia sac and settling in the pockets between the folds of the sac might have caused the inflammatory reaction with resulting adhesions and fusion of the folds. The phagocytic cells containing blood pigment might represent the incomplete absorption of this blood or blood from the menstrual reaction of the endometrial tissue in the lesion. The endometrial tissue developing in the bottom of the pockets must represent either an implantation of endometrial tissue which we know is often present in menstrual blood or else the reaction of the peritoneal mesothelium to some specific ingredient of this blood. I believe the former.

Some of the peritoneal lesions could have arisen from the escape of the contents of the endometrial cyst into the peritoneal cavity but those in the anterior culdesac (Fig. 13) suggested a more recent development than those about the left ovary. Their distribution could be more readily attributed to material escaping through the left tube; both tubes were patent.

It would seem that we are warranted in assuming that the peritoneal lesions arose from the local reaction of the peritoneum to blood or bloody fluid escaping either through the tubes as a back flow of menstrual blood or from the perforation or rupture of the endometrial cyst of the ovary or from both of these sources. The

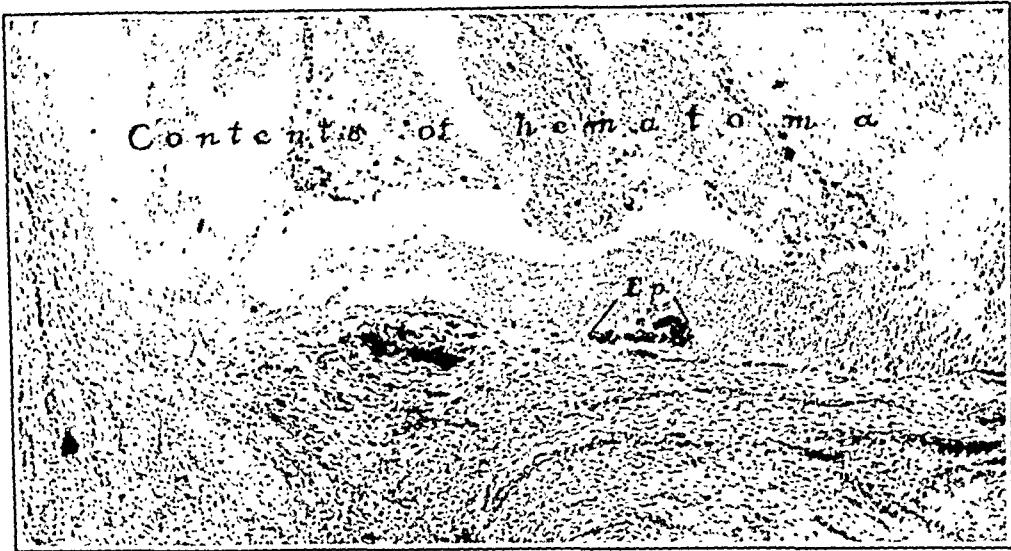


Fig. 33.—Photomicrograph (x 60) of a portion of the wall of the hematoma shown in Fig. 31. In places an epithelial lining of cuboidal cells is present. The contents consist of blood, phagocytic cells containing blood pigment, and cast-off portions of the epithelial lining. The lining of this hematoma and its contents are similar to that of portions of the endometrial cyst of the ovary, and thus suggests an endometrial origin for the former.



Fig. 34.—Photomicrograph (x 60) of a portion of the wall of the hernia sac containing endometrial tissue shown in Fig. 31. The histologic structure of the endometrial tissue is identical with that often found in a direct or primary endometriosis arising from the invasion of the uterine wall by its mucosa.

newly-formed connective tissue, containing phagocytic cells and mesothelial inclusions could have arisen and probably at least partly arose from this source. The endometrial tissue present in these peritoneal reactions must have been formed either from the engrafting of fragments of endometrial tissue, which we know are often

present in menstrual blood, or else in some way the peritoneum was converted into endometrial tissue by an irritant present in menstrual blood and not found in other well-known agents of peritoneal irritation.

The lesions in the hernia sac (Figs. 6 and 25 to 34 inclusive) were similar to those in the natural peritoneal depressions of the pelvic cavity and undoubtedly had a similar origin.

Glands or tubules of endometrial type were present on the outer surface of the portion of the left ovary which was fused with the posterior layer of the broad ligament. These could be traced through the wall of the cyst into the endometrial tissue lining its cavity (Figs. 18 and 19). This suggested that the endometrial tissue in the ovary came from this source and that the cyst arose from the accumulation of blood (menstrual) in an endometrial cavity developing in the ovary, just as a similar cyst or hematoma might have developed in the endometrial cavity present in the anterior wall of the uterus (Fig. 20). The endometrial tissue in the left ovary must have come either from an implantation or else from the stimulation of potential endometrial tissue in that organ.

Menstrual blood escaping into the peritoneal cavity as a back flow through the tubes might have directly or indirectly caused all of the endometrial lesions present in this case by the local irritation of the peritoneum and the implantation and growth of endometrial tissue present in this blood or from the specific influence of some ingredient of that blood on the peritoneal mesothelium and surface epithelium of the ovary. My reaction is that the endometrial tissue in the peritoneal lesions originated by implantation in the same manner as the cancer in peritoneal carcinoma may arise from the implantation of fragments of cancer escaping into the peritoneal cavity, and as experimentally proved by Jacobson in the lower animals, and that the endometrial tissue in the ovary might or might not have had a similar origin.

#### CONCLUSIONS

The clinical and pathologic study of pelvic peritoneal endometriosis convinces me that it is usually due to the escape of menstrual blood into the peritoneal cavity with the subsequent local reaction. Menstrual blood at times passes into the peritoneal cavity as a back flow from the uterus through the tubes, from the tubal mucosa itself, from the perforation of an endometrial hematoma of the ovary and possibly from endometrial tissue on peritoneal surfaces. Menstrual blood, like other irritants, causes granulation and scar tissue, adhesions and peritoneal inclusions. In addition endometrial tissue is often found on the surface of or imbedded in these peritoneal lesions and must arise either from the implantation of fragments of uterine mucosa which we know are often present in menstrual blood, or else in some way the peritoneum is converted into endometrial tissue by the specific stimulation of some ingredient of this blood. The experimental work of Jacobson demonstrates that similar peritoneal lesions may be produced in rabbits and monkeys by scattering bits of their uterine mucosa in the peritoneal cavity of these animals. Clinical observations indicate or at least suggest that

endometrial tissue may be successfully transplanted in human beings. The local peritoneal reaction towards the menstrual blood creates conditions favoring the retention and engrafting of any living tissue in this blood, just as similar reactions make possible the implantation of fragments of cancer escaping into the peritoneal cavity. These implantation-like lesions occur most frequently in the dependent portions of the pelvis and in its normal peritoneal pockets and folds. It is natural to assume that they might occur in a hernia sac just as tuberculosis and carcinosis have been found in the hernia sacs of patients having peritoneal tuberculosis and carcinosis. A case is reported of pelvic peritoneal endometriosis associated with an endometrial cyst of the ovary and an inguinal hernia. Peritoneal lesions containing endometrial tissue were present in both the anterior and posterior culdesac and also in the walls of the hernia sac including its neck, the lumen of the latter having been occluded (or nearly so) by the endometriosis in this situation. Observations made at the operation and the laboratory study of the specimens removed indicate that the pelvic peritoneal lesions and those of the hernia sac had a common origin and from some material escaping into these cavities and the local reaction to the same, I believe that this material was menstrual blood. The endometrial cyst of the ovary is evidence that a perforation may have occurred and the patent tubes are two avenues by which menstrual blood may have reached the peritoneal cavity and the hernia sac.

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(For discussion see page 623.)

# THE SIGNIFICANCE OF UTERINE MUCOSA IN THE FALLOPIAN TUBE, WITH A DISCUSSION OF THE ORIGIN OF ABERRANT ENDOMETRIUM\*

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THE gynecologic literature of recent years contains no finer example of scientific research than is presented by the clinicohistologic studies of Sampson<sup>1</sup> upon the general subject of pelvic endometriosis. Though not the first to describe the occurrence of ectopic endometrium, none will dispute the fact that his studies have thrown an entirely new light upon the subject, not only by emphasizing the great frequency of the lesion, but also by offering a point of view broad enough to embrace a number of conditions hitherto described as quite separate entities, and infrequent ones at that. Gynecologists the world over have been put on the alert for this condition, and the work of the gynecologic pathologist has been given a new zest.

In common with others, we have searched our material from this standpoint, and have found endometrial tissue in many cases where its presence formerly had been overlooked. The fact that its incidence in our observation has been considerably less than that found by Sampson may be due to less searching examination of our pathologic material, to differences in interpretation, or to both these factors.

The present communication, however, does not deal with the general subject of endometriosis, but only with one of its aspects, the manner of origin of the ectopic endometrium. The menstrual regurgitation theory suggested by Sampson is a somewhat alluring one, and has attained rather general acceptance. Sampson has extended the idea of tubal transmission of tissue material to the field of cancer, and believes that ovarian cancer may be the result of the implantation into the ovaries of cancer material which has passed out from the uterus through the tubal lumen. The tubal regurgitation theory of Sampson, therefore, assumes a very pivotal importance in connection with both pelvic endometriosis and pelvic cancer, and hence it would seem worth while to bring forth all evidence tending to prove or disprove its correctness. It is only fair to say that Sampson has taken a very open-minded stand on this question, and recognizes the possibility of other etiology factors than the one of tubal regurgitation. It is the latter,

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\*Read at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 22, 1926.

however, which he has particularly stressed, and which he has applied, not only to endometriosis, but also to the question of the possible extension of fundal carcinoma. It is this theory which has, therefore, been definitely associated with his name.

The demonstration of tissue in transit in the tubal lumen would seem especially important in the elucidation of this problem, and yet only a few observations of this sort, chiefly very unconvincing, have been made. With the recent great development of interest in the histology of the uterus and ovaries, which has been stimulated by our new knowledge of the cyclic physiologic changes which they exhibit, there has been very little interest in the study of the fallopian tubes. And yet, such a study offers rich rewards. For example, no one has, so far as I know, ever indisputably demonstrated a human ovum in its tubal stage, i.e., before implantation. All of the young human embryos which have been described have already been implanted in the uterus, and we are, of course, lacking in direct observations upon the preimplantation phases of development of the fertilized ovum. This important gap will be filled sooner or later, no doubt, by the discovery of the fertilized ovum in the tube.

It is surprising, in view of the countless sections of tubes which have been studied the world over, that such a discovery has not already been made, especially when one considers the comparative ease with which the ova can be recovered in some of the lower animals by washing out the generative tract.<sup>2</sup> In pigs, in which the occurrence of ovulation is definitely related to coitus, such studies have yielded ova at all stages of early development, as can be seen in the remarkable series of photographic studies in the Carnegie Institute of Embryology, shortly to be published by Dr. Streeter, director of the Institute.

In the human being the problem is rendered far more difficult by the uncertainty as to the exact time at which the individual woman ovulates, but there is no reason why persevering studies, made on the tubes of women operated upon at the usual time of ovulation, should not sooner or later yield a valuable material. I have recently been trying to develop a clinical technic of tubal washing, based upon that employed in some of the lower animals, but cannot report on this as yet. It would seem to be the simplest method of demonstrating the presence of loose bits of endometrial or cancer tissue.

The method of study employed for the present investigation was the much more prosaic one of studying large numbers of sections of tubes, in the hope that bits of uterine mucosa would luckily be encountered in the occasional case. Serial section study of a structure like the fallopian tube is, of course, impracticable. Without this, even the study of numerous sections from many blocks may miss any contained bits of uterine mucosa. By the study of hundreds of tubal

sections we have in a small series of cases been rewarded by being able to demonstrate endometrial particles of various sizes lying free in the lumen. Small as the number is, I believe it is larger than has been available in the entire literature heretofore. Indeed, I have been able to find only five similar cases, in addition to the one pictured by Sampson, which impresses me as rather unconvincing. In 1912, long before Sampson's work, Jägeroos<sup>3</sup> briefly described three cases, in all of which the migrating endometrium was evidently of the nonmenstruating type (postmenstrual or interval). Nothing is said of the condition of the ovaries, and no menstrual histories are given. In Lahm's recent case<sup>4</sup> the operation was done on the sixteenth day of the cycle, and in Cordua's case,<sup>5</sup> even more recent, there had been constant bleeding from a cervical cancer for six weeks. In the former the endometrium showed an early interval picture; in the latter it was in an early premenstrual phase. Both authors discuss the possibility of the endometrium having been squeezed into the tubes by the operative manipulation, and both express the view that such an occurrence is not sufficiently common to lend support to Sampson's theory.

More important than the mere demonstration of this tissue in the tubal lumen, however, is the application of these findings to Sampson's theory of menstrual regurgitation. Some of my cases are of exceeding interest in this respect, while the others possess much less significance, chiefly because of the fact that all or a part of the ovarian tissue was conserved to the patient, and hence was not available for study. Even when the ovary is available, it is easy to miss endometrial tissue unless blocks are cut from the fresh, unfixed tissue, for fixation obliterates the distinctive appearance of the endometrium unless present in large amount, as with definite chocolate cyst formation. It is well worth while, in all suspected tissue, to cut numerous blocks when the tissue is still fresh. Endometrial tissue will be found much more elusive when one searches for it in ovaries which have been fixed, as I have found to my regret in this study. No other problem in gynecology illustrates more forcibly the importance to the surgeon of being his own pathologist.

#### CASES SHOWING ENDOMETRIAL TISSUE LYING FREE IN THE TUBAL LUMEN

CASE 1.—The patient, A. M., was forty-eight years old and complained chiefly of painful menstruation and painful defecation. These symptoms had been present for two years. Menstruation had begun at twelve years. It occurred at regular four-week intervals and lasted 7 days (formerly 5 days). There was severe colicky pain on the first two days. The last period had begun on June 14. For two years there had been severe pain on defecation, especially on the first few days of menstruation.

*Examination* showed the uterus to be of normal size and in normal position. Behind the cervix there was a small cluster of nodules, the largest about the size of a pea. Both tubes and ovaries appeared to be adherent and tender, though not much enlarged.

*Operation*, on July 11, consisted in supravaginal hysterectomy, double salpingo-oophorectomy, and appendectomy. The uterus was slightly above the average size and adherent posteriorly to the rectum. The tubes were patent and, together with the ovaries, matted to the posterior surface of the uterus and broad ligaments. On separating these adhesions each ovary was seen to contain a chocolate cyst about 3 cm. in diameter. A number of small nodules, containing chocolate-colored blood, were found in the uterosacral ligaments. The rectum was adherent to the back of the cervix.

Fig. 1 shows a section of the outer third of the right tube. Within the lumen one rather large and several smaller particles of perfectly definite uterine mucosa are seen. The uterus shows a typical premenstrual endometrium (Fig. 2). The ovaries both show considerable endometrial tissue, the most interesting feature, from the present standpoint, is the presence on the free surface of premenstrual

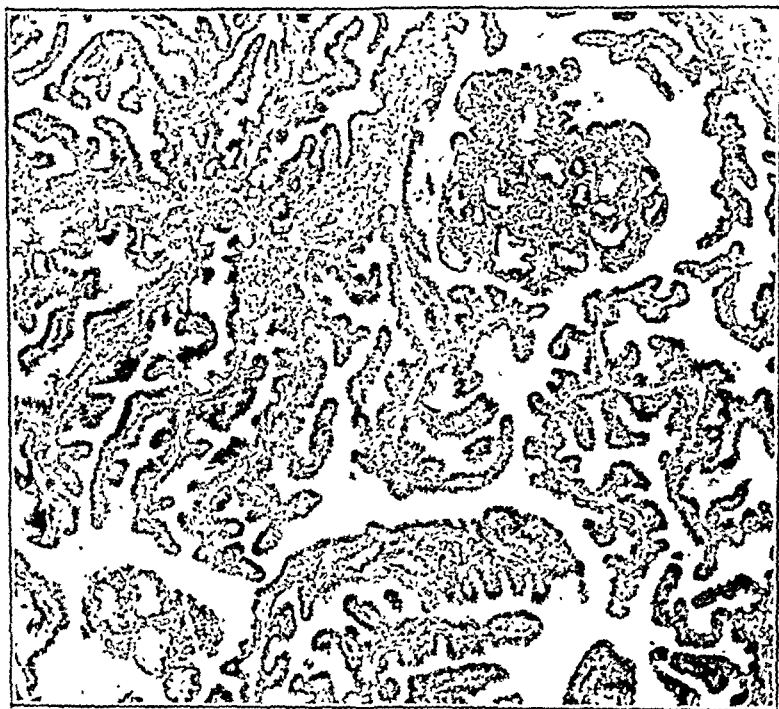


Fig. 1.—A section of the outer third of the tube, showing several particles, one quite large, of well-preserved premenstrual endometrium (not menstrual or degenerated). The woman was not menstruating, and the uterine endometrium shows a characteristic premenstrual hypertrophy (see Fig. 2). The patient expected to menstruate in a day or two. The larger bit of mucosa in the tube (upper right quadrant) could hardly have entered the inner orifice of the tube (see Fig. 4). The logical source of the migrating mucosa is the endometrium on the free surface of the ovary (see Fig. 3). The same magnification was used for Figs. 1, 2, 3, and 4.

endometrium just like that in the uterus, but also like that which lies free in the lumen (Fig. 3). The illustration, moreover, shows the polypoid projection of premenstrual endometrium to be directly continuous with mucosa exactly resembling that which is normally found lining the tube. It is apparently the fimbria ovarica.

*Comment.*—At first thought one might interpret the findings in this case as confirmatory of Sampson's theory of tubal regurgitation of uterine mucosa. There are a number of serious objections to such an interpretation.

In the first place, the woman was not menstruating, a fact which was checked up before as well as after the operation. Secondly, the





Fig. 2.—Intact endometrium, with premenstrual hypertrophy, of patient in whose tube free mucosa was found (see Fig. 1). The ovary of the same side showed premenstrual endometrium also (Fig. 3).

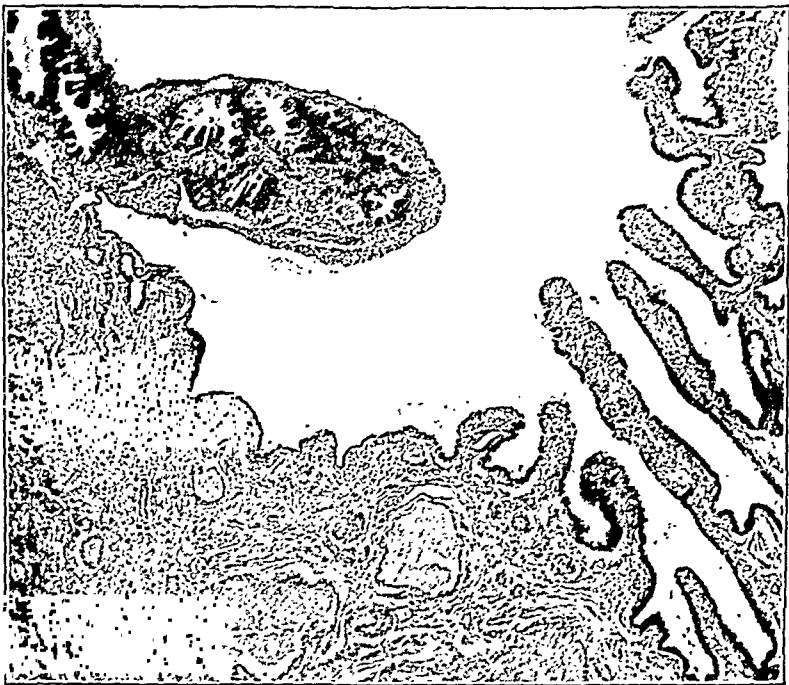


Fig. 3.—Polypoid mass of premenstrual endometrium on surface of ovary, near hilum, in close contact with the open mouth of the tube. There was a great deal of endometrium in other parts of the ovary also, and this offers a logical explanation for the free particles, which have probably broken off from the ovary and are migrating down the tube toward the uterus (see Fig. 1). This is certainly far more likely than to assume that the free particles broke off from the uterine surface entered the tiny uterine opening of the tube, traveled up-stream, and, after several days, were still able to grow on the ovary.

mucosa of the uterus is not of the menstruating type, but is typically premenstrual, with no signs of degeneration and with an intact surface covering. Thirdly, the tissue which lies free in the lumen of the tube is likewise of the premenstrual type, and is well preserved. Fourthly, the migrating bits of uterine mucosa are so large that it is almost incredible that they could have made their way into the uterine end of the tube. A section of the cornual portion of the tube is shown in Fig. 4, and is seen to be narrower than the larger portion of endometrium in the tubal lumen. Fifthly, the endometrium on the surface of the ovary offers a far more logical explanation of the uterine tissue in the tube. It is easy to see how particles of the

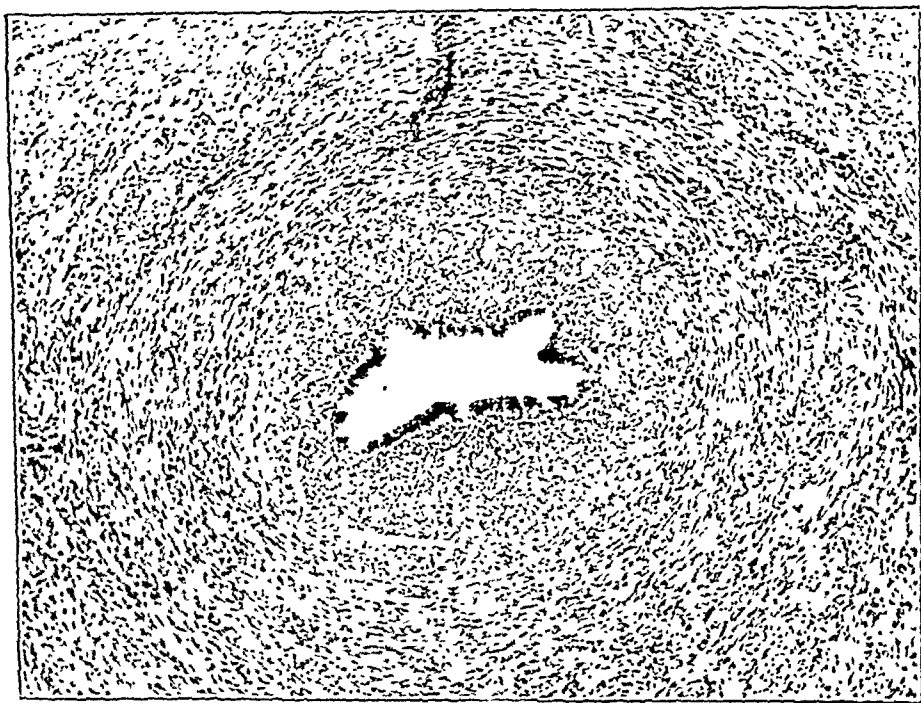


Fig. 4.—Section of interstitial portion of the same tube shown in Fig. 1, which contains free uterine mucosa. The lumen, which is of about the usual size for the normal tube in this region, seems too small to give passage to such a large particle of mucosa as is seen in Fig. 1, or in Figs. 7, 8, 9, or 10. All these photomicrographs are with the same magnification.

ovarian endometrium can break off, readily entering the wide open funnel of the tube and passing down its lumen, just as the ovum does. In other words, I believe that the evidence in this case points to the ovary as the origin of the migrating endometrium, which, therefore, is passing towards and not from the uterine cavity.

The same explanation can be made of the single example pictured by Sampson of free endometrium in the tube. It is possible that the colored photomicrograph may not do his section justice, for it would seem to leave doubt as to the endometrial nature of the tissue in the lumen of the tube. Aside from this, however, free endometrium in such a case, according to my observations, would be much more

likely to have its source in the ovary. This interpretation of Sampson's case is strengthened by the picture which he presents of a large endometrial area near the surface of the ovary of the same case. This, to my mind, is the logical source of the endometrial tissue in the lumen of the tube.

There is no reason, of course, why endometrial tissue should not sooner or later be found in the lumen of tubes removed during actual menstruation. Even if it were, I believe that the evidence presented in this paper would indicate that it had its origin in the ovary rather than in the uterus.

CASE 2.—M. R., white, aged forty-eight years, was admitted on July 31, 1925, with a history of irregularity of menstruation for 8 years. The periods began at fifteen years, and had previously occurred at 4-week intervals, with a moderate flow lasting one week. About 8 years ago the menses became irregular, with periods of amenorrhea often lasting 3 months. They were at times quite free and prolonged (6 days to 2 weeks). On Dec. 1, 1924, there was a free flow lasting 2 weeks, then amenorrhea to March 1, at which time a normal period occurred. Following this there was amenorrhea to June 1, when a free flow of 5 days occurred. Since then there has been some irregular bleeding, with slight dull pain in the lower abdomen. The patient had been married 30 years and had had 12 full-term pregnancies.

*Examination* showed marked relaxation of the outlet, with cystocele and rectocele. The cervix was three times the normal size, with a deep laceration, but no suggestion of malignancy. The fundus was likewise enlarged to two or three times normal size, but no adnexal abnormalities were palpated.

*Operation*, on August 1, 1925, showed the uterus to be three times the normal size as the result of the presence of adenomyoma. Because of the patient's age, the long history of bleeding, and the condition of the cervix, panhysterectomy was done, together with double salpingo-oophorectomy. The tubes were open at the time of operation and the ovaries were described as relatively normal. The section shown in Fig. 5 is taken from the right tube and contains definite endometrial stroma in its lumen, but without glands. There is also a definite but small amount of endometrium in the hilum of the right ovary (Fig. 6). The uterus shows an adenomyoma and the surface endometrium exhibits a typical interval pattern, with a tendency to mild hyperplasia in some areas, and is, of course, totally different from that of a menstruating endometrium.

Here again we have endometrium in a tube which is open to communication with an ovary also containing endometrium. The operation was done at a time apparently removed from menstruation, the endometrium being of the characteristic interval type.

CASE 3.—L. W., colored, aged twenty-five years, was admitted on June 15, 1925. Her chief complaint was pain in the lower abdomen, chiefly left-sided, since September of 1924. There was also considerable dysmenorrhea and some leucorrhea. The menses had appeared at fourteen, with 28-day intervals and moderate flow lasting 4 days. The date of the last period was June 1, 1925, the one preceding, May 3, 1925. She had been married 12 months and had had 3 miscarriages in the past few years.

*Examination* showed marital outlet, with no relaxation. Cervix high in vault, pointing downward and backward. The uterus was normal in size and position. The left tube and ovary were definitely adherent though only slightly enlarged. The right adnexa could not be felt.



Fig. 5.—Section of tube containing an island of what is evidently uterine stroma, though no glands are seen. The patient had had slight irregular bleeding for two months, but the uterus shows a characteristic interval endometrium. The likely source of the endometrium in the lumen would seem to be the ovary of the same side, for it contains endometrial tissue (see Fig. 6).



Fig. 6.—Ovary of same case as tube shown in Fig. 5. It shows definite endometrium. It is probable that more abundant areas could be found if extensive search were made for them.

At operation, on June 16, 1925, the otherwise normal uterus was found tightly adherent to both rectum and bladder. Both tubes were open but both showed considerable enlargement and thickening, with firm surrounding adhesions. The operation consisted in left salpingo-oophorectomy, right salpingectomy, modified Coffey hysterectomy and appendectomy.

The section illustrated in Fig. 7 shows definite endometrial tissue in the right tube. Its structure suggests that it might have been thrown off from the ovary several days earlier, as it is typically postmenstrual. There were a few small tubules on the surface of the left ovary. It was doubtful whether these could be considered real endometrium. This patient was not menstruating at the time of the operation, which was done on about the fifteenth day of the cycle. The ovary on the side of the tube which contained endometrium was not available for study.

CASE 4.—D. S., white, aged forty-eight years, entered the hospital on September 24, 1924, with a history of uterine bleeding for 3 months. Menstruation began at 13, was always irregular, with intervals varying from 21 to 25 days. The duration was 7 or 8 days; the amount was rather large, and there was slight dysmenorrhea. For one year there had been marked irregularity, with frequent attacks of

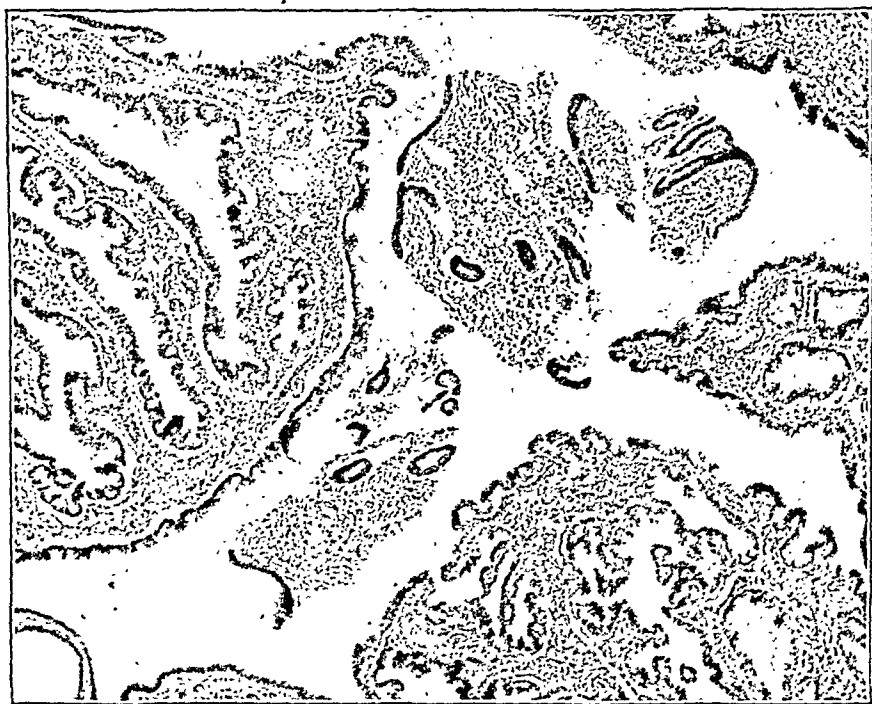


Fig. 7.—Tube removed on fourteenth day of menstrual cycle, with several large particles of uterine mucosa in the lumen. Neither the uterus nor the ovary on the side of this tube was removed. Certainly, however, neither the menstrual history nor the appearance of this tissue would justify any association with menstruation. The typical postmenstrual character of the endometrium suggests that it had been thrown off several days earlier.

moderate bleeding, lasting usually 7 to 9 days, with periods of about 10 days between these of only slight show of blood. The last menstrual period occurred on September 17, 1924. There was no bleeding at the time of admission to the hospital. The patient had been married 22 years. There was one child, twenty-one years old. The delivery had been instrumental and had been followed by a pelvic abscess, necessitating pelvic puncture.

Examination showed a retroverted, adherent uterus and marked tenderness, without much enlargement, in both adnexal regions.

At operation, performed September 25, the uterus was found to be held to the rectum and sigmoid by fine avascular adhesions. Both tubes were slightly thickened and adherent to the ovaries, although the fimbriated ends were open. Aside from the light adhesions, the ovaries were normal. Both tubes were removed, but the

uterus and ovaries were conserved, except for a small bit of one ovary, which was excised in order to facilitate removal of one of the adherent tubes.

The pathologic examination showed a mild chronic salpingitis. In one of the tubes there was found a large particle of unquestioned endometrial tissue (Fig. 8). It showed a postmenstrual pattern and was well preserved. The operation in this patient was done on the eighth day of the menstrual cycle, shortly after the cessation of a menstrual period. (See menstrual history.) The material available for study does not, of course, clear up the question of the endometrial tissue in the tubal lumen. The history, however, demonstrates quite clearly that it cannot be related to menstruation, which occurred 8 days before. Aside from this, the tissue is too well preserved to be interpreted as tissue cast off at menstruation, while the histologic pattern is definitely that of the postmenstrual and not the menstruating phase.



Fig. 8.—Section of the tube showing a large particle of uterine mucosa. Operation was done on the eighth day of the cycle, and the endometrium in the tube shows the usual postmenstrual picture. The uterus and both ovaries were conserved. The latter were described as adherent, and may very possibly have contained the endometrium, which would explain the free bits in the tube. An origin from the uterus seems difficult to imagine, if one compares the size of the particle with the usual size of the interstitial tube, as shown in Fig. 4.

CASE 5.—L. R., white, aged thirty-eight years, was admitted on February 1, 1925, with the complaint of pain in the left lower abdomen, since an appendectomy eighteen years previously. Menses had begun at eleven years, the intervals were 28 to 30 days, the duration was 4 to 6 days, the amount was free, and there was severe dysmenorrhea. The date of the last period was Jan. 23, 1925. The patient had been married twice (total period 23 years). There had been in all two children and one miscarriage.

Examination showed, in brief, a moderately relaxed outlet; laceration of cervix; fundus normal in size and position; adherent and tender adnexa.

Operation was done on February 2, 1925. There were no intestinal adhesions to the old scar. The uterus and right adnexa were comparatively normal, except for adhesions of the small intestine and the omentum to the ovary. The left tube and

ovary were adherent, although the fimbriated end of the tube was patent, as was that of the right tube. Left salpingo-oophorectomy was done, with a modified Coffey suspension.

The tube in this case was found to show a large particle of uterine mucosa in the postmenstrual phase (see Fig. 9). The woman was not menstruating, the operation being done on the tenth day of the cycle. The ovary showed extensive interstitial hemorrhage, and in some sections small, gland-like spaces were seen just below the surface. It is probable that this ovary contains endometrial tissue, although I have not yet been able to demonstrate it in an unquestioned way in the fixed specimen.

CASE 6.—M. F., colored, aged twenty-eight years, was admitted on September 10, 1925, complaining chiefly of uterine bleeding. Menstruation had begun at twelve years, and was formerly regular at 28-day intervals, the duration being 3 or 4 days, the amount rather free, with slight pain. In 1919 the patient began to have

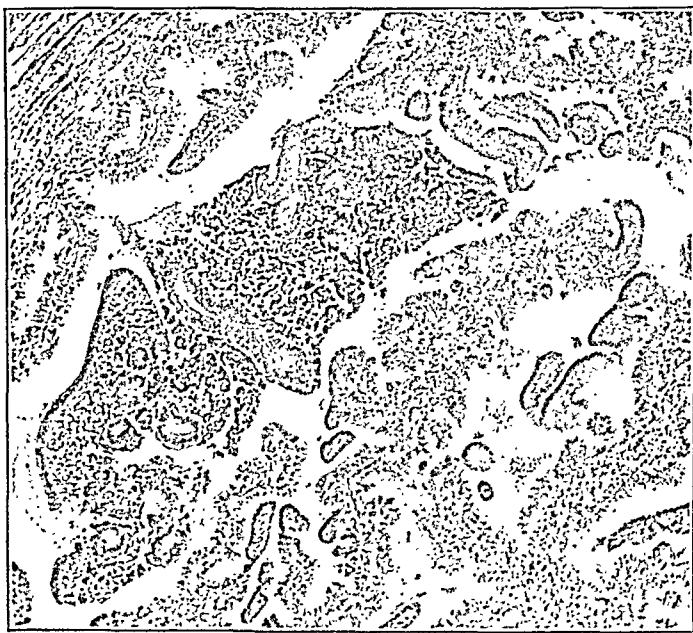


Fig. 9.—Large fragment of uterine mucosa lying free in the lumen of a tube removed on the tenth day of the cycle. It shows a postmenstrual picture, suggesting that it might have been thrown off from the ovary two or three days earlier. It could hardly be explained in any other way, in view of its large size, its histologic structure, its good preservation and the fact that the patient was not menstruating. The ovary showed extensive "interstitial hemorrhage" and almost surely contained endometrium, although it was not demonstrated, as the gross specimen was no longer available at the time of this study.

occasional amenorrhea of 2 or 3 months, often followed by menorrhagia, although there was no evidence of abortion as a cause of this. Dysmenorrhea and leucorrhea were also present. There was a regular menstrual period about August 15, 1925. Bleeding began again on September 1 and was still present when the patient was admitted. The patient had been married 6 years and there had been 3 pregnancies, one terminating in stillbirth at term, the other two in early miscarriages.

Examination showed outlet without much relaxation; a slight bloody vaginal discharge; the cervix large and hypertrophic; the fundus normal in size and position; the tubes tender, adherent, and somewhat enlarged.

Operation on September 12, 1925, showed both tubes the seat of definite inflammatory disease, with marked adhesions and considerable angulation. The fimbriae were open. Both ovaries were apparently normal, except for surrounding adhesions.

The uterus was adherent to the rectum posteriorly. Panhysterectomy, with double salpingectomy, was done. Only a small cystic bit of the left ovary was removed.

The most interesting find on microscopic examination is seen in Fig. 10, which shows several large bits of uterine mucosa caught in transit. It is of the postmenstrual type, while that of the uterus is of the early interval type. Unfortunately, no ovarian tissue is available for examination, but I believe it would have shown endometrial areas. Such large particles as are here shown could scarcely have made their entrance into the uterine end of any tube, but they could quite readily have dropped into the wide open fimbriated end. Certainly neither their own appearance nor that of the uterine endometrium can associate them in any way with menstruation.

CASE 7.—D. II., colored, aged eighteen years, was admitted on August 16, 1925. There had been dull, aching pain in the left lower abdomen since August 3. A



Fig. 10.—Tube removed on the ninth day of the cycle, showing a large particle of postmenstrual endometrium, with only a few glands. The uterus showed a typical interval endometrium, so that there is much reason to believe that the migrating endometrium, which is of the postmenstrual type, was cast off from the ovary several days before the operation. It would hardly have gotten into the tube from the uterine side, and the uterine mucosa shows a more advanced development than the tubal particle. The ovaries were both conserved. They were described as "normal except for surrounding adhesions," and the uterus was adherent to the rectum. I believe that endometrium would have been found in the ovaries had they been removed.

slight amount of dark reddish discharge had been present during this time (one or two napkins a day). There was some burning on urination and some vesical and rectal tenesmus. Menstruation had begun at thirteen years, with 4-week intervals, rather free, lasting 7 days; there had been dysmenorrhea for 3 or 4 years. The patient had been married 2 years but had had no pregnancies.

Examination showed a nulliparous outlet, with no bleeding at time of examination. The cervix was quite high in the vaginal vault. The uterus was of normal size and pushed to the left by a small, adherent mass in the right side of the pelvis.

Operation, on August 20, showed many old and firm omental adhesions. There was about 150 c.c. of light, straw-colored fluid in the pelvis, but no blood. Both



tubes were apparently closed at their fimbriated extremities, which, however, were not completely inverted. They were only moderately enlarged and thickened, but there were definite nodes at each isthmus. The right ovary was the seat of a definite abscess about 4 cm. in diameter and matted in adhesions. The left was comparatively normal except for adhesions.

The illustration (Fig. 11) is from the right tube. Definite tuberculosis was found in both tubes and also in the right ovary. The left ovary was not removed. The particle of tissue in the lumen certainly looks like a uterine gland and stroma. How did it get into the tube? Scarcely through the uterine end, for this was the seat of a typical tuberculous salpingitis isthmica nodosa, which blocked the lumen completely. Tuberculous tubes are notoriously prone to remain partially patent at the fimbriated ends. This channel of communication would seem to be the likelier



Fig. 11.—Part of the wall of tuberculous tube, showing small bit of what seems to be definite endometrial tissue lying free in the lumen. The menstrual history of this patient, who was colored, was rather indefinite, but she is said to have had a slight reddish discharge for two weeks before operation. The glands in the endometrial particle suggest a beginning premenstrual change. The point of chief interest is the fact that the tube was blocked at its uterine end by a tuberculous salpingitis isthmica nodosa, while the fimbriae, as is so common with tuberculous tubes, were described as partially everted, so that the tubal orifice was almost surely not completely blocked. This makes the ovarian origin of the endometrium very probable, though it cannot be proved, as the ovary on the side of the tube was not removed. The other ovary and tube showed tuberculosis. The uterus was conserved.

one in this case, as the fimbriae were partly everted in the tube in which the endometrium was found.

CASE 8.—E. McN., colored, aged thirty-eight years, was admitted to the hospital on December 18, 1916, with a history of sharp, colicky pain in the lower abdomen for the three weeks preceding. She had been married 23 years and had two children, twenty-one and nineteen years of age. Menstruation had begun at eleven years, was regular every 4 weeks, lasting 3 and 4 days, with some dysmenorrhea. For 1 year there had been some irregularity, the periods often appearing twice a

month. The last period began on November 20, 1916. Following this there was a whitish discharge with some bloody admixture.

*Examination* showed a uterus which was definitely enlarged, while in the culdesac there was felt a tender, indurated mass.

*Operation*, on December 21, 1916, showed the right tube to be the seat of an unruptured pregnancy. Its inner half was comparatively normal in appearance, while the outer portion was about 4 cm. in diameter. The left tube was adherent and its fimbriated end was sealed off. The operation consisted of right salpingo-oophorectomy and left salpingectomy. The right tube, when opened through the distended area, showed a collection of blood in which there was a chorionic sac containing a fairly well preserved embryo of about nine weeks' development, according to the estimate of Dr. Mall, then Director of the Carnegie Institute of Embryology.

Microscopically, the usual picture of tubal pregnancy was found in the right tube. In one of the sections taken between the embryonic area and the uterus

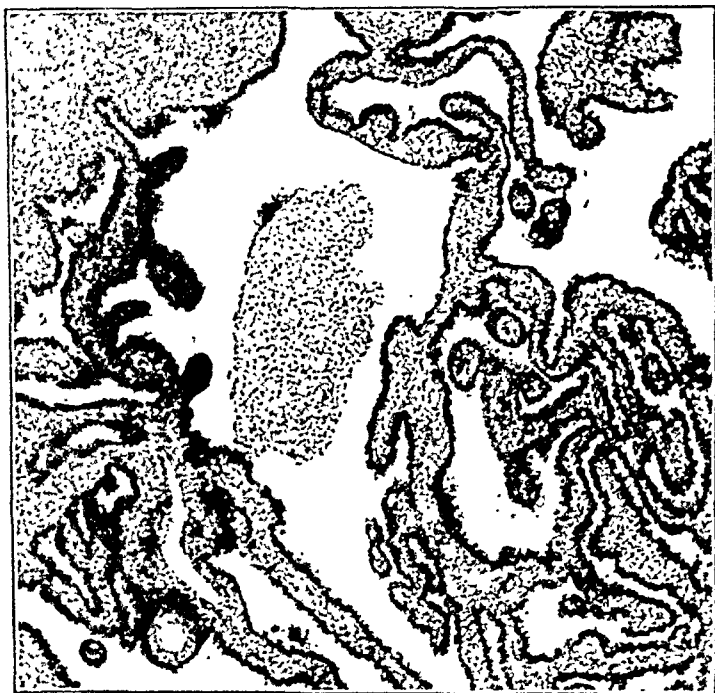


Fig. 12.—Section of tube showing follicular salpingitis. In the lumen is seen a clump of cells resembling the trophoblastic nodules (by some considered decidual) found so commonly in sections of pregnant tubes. There was a pregnancy in the outer portion of this tube, and sections through the implantation area show islands like that shown in the illustration. This was made from a section between the pregnancy and the uterus, indicating that the particle was migrating down the tube toward the uterus.

there was seen, lying free in the lumen, the island of cells shown in Fig. 12. They are exactly similar to many cell islands seen in sections through the pregnancy, and which represent the so-called trophoblastic nodules. While this case has no immediate bearing upon the question of possible endometrial transportation through the tubes, it is suggestive as another example of transportation of tissue in a downward direction, towards the uterus.

#### DOES MENSTRUAL BLOOD REGURGITATE THROUGH THE TUBE INTO THE PELVIS?

In the past few years we have, whenever the opportunity presented itself, operated upon women who happened to be menstruating, and

we have always carefully examined for evidence of the escape of blood from the tubes, when these were patent, as they were in at last 13 of the menstruating women upon whom operation was done. In not a single case was it possible to demonstrate the escape of blood from the tube, or the presence of free blood in the pelvic cavity. In only one case, in my own experience, so far as I recall, could I feel that blood had passed back from the uterus into the pelvis, and that single case was not related to normal menstruation. It was a case of very profuse climacteric hemorrhage of many days' duration, in which a physician had inserted an extremely firm tampon to control the bleeding before sending the patient into the hospital. At the operation, which was a hysterectomy, a small amount of free blood was found in the pelvis, presumably having been forced back from the uterus.

A favorite time for pelvic operations is immediately after the cessation of the menstrual period. This time appears to be popular with both patients and surgeons. For instance, many patients who begin to menstruate after admission to a hospital are held over and operated upon immediately after the cessation of the period. If menstrual regurgitation through the tubes were common, would we not, in the innumerable operations done just after the period, often find traces of blood in the pelvis? If our observations in cases of tubal pregnancy can be taken as a guide, this question must be answered affirmatively. It is hard to believe that free blood would disappear so quickly, or that so many thousands of surgeons could have been so unobservant as to fail to notice it if it were present at this time.

Again, histologic examination of tubes removed during menstruation usually shows them to be free of any bloody content. Occasionally, a small amount of blood is seen, but not any more commonly than is the case with tubes removed at other parts of the cycle (Fig. 13). Even if, in the occasional case, blood were demonstrated escaping from the tubal end, it would be difficult to exclude the existence of pathologic conditions in the tube (mild salpingitis, etc.). Some of the few reported cases of menstrual regurgitation are obviously inaccurate. For example, the case reported by Schmid<sup>o</sup> was almost certainly one of bleeding from a tubal abortion. He states that the patient had amenorrhea for two months, followed by bleeding for five days. The tube was distended in several places and there was slight bleeding from the fimbriated end. The tube was not removed, so that no histologic study was made.

Furthermore, it is difficult to understand why the escape of menstrual blood into the abdominal cavity would not often cause symptoms of peritoneal irritation similar to those seen with hemorrhage from the tube in tubal abortion. If our ideas of the latter are correct, each escape of blood, however slight, produces pain, often nausea and

vomiting, and sometimes shock. The peritoneal reaction is likewise reflected in the leucocyte curve, according to the observations of Farrar. There is no reason to believe that menstrual blood is less irritating than that escaping with tubal pregnancy.

Finally, it is difficult to understand why menstrual blood, thrown into the pelvic cavity, would not cause sufficient peritoneal irritation to produce much more frequent tubal closure. If, as Sampson believes, it is the cause of the marked inflammatory reaction seen in cases of pelvic endometriosis, one would expect, perhaps, a maximum of reaction around the fimbriated ends of the tubes. And yet they are characteristically open. My own impression is that the menstrual blood given off, usually in small amounts, from the ovarian and other



Fig. 13.—Characteristic appearance of tube removed at height of menstruation (section near fimbriated end). This patient had been menstruating freely for twenty-four hours, but no blood is seen in the tube.

islands in the pelvis, does actually cause the adhesions which are so common, and that the tubes are not closed because they not only pour out no blood themselves but are not usually brought into contact with it, when the endometrial islands are small and scattered. When they are larger, as with definite chocolate cysts in the ovary, the fimbriae are often matted over the ovarian surface.

Sampson states that he has occasionally observed menstrual regurgitation through the tubes, and a few other authors have made similar general statements. My search of the literature and my inquiries among surgeons, however, have yielded little or no specific information on this point. Perhaps the experiences of the members of such a society as this may throw some light on this point. The

occasional occurrence of regurgitation cannot be denied, but I am strongly of the opinion that it must be too infrequent to explain such a common condition as endometrial ectopia.

CAN ENDOMETRIAL TISSUE UNDERGO RETROGRADE TRANSPORTATION  
INTO THE PELVIS?

Even if the liquid menstrual discharge could be carried out into the pelvis, it is not easy to see how solid particles of tissue could follow this route. Nature may make some blunders, but there is surely a definite purposefulness in the propulsion of the tubal contents toward the uterus rather than toward the peritoneal cavity. It is the well-beaten path followed by the ovum, which, if our ideas be correct, is drawn into the funnel by the ciliary current and slowly propelled along the tube by the action of the cilia, with possibly some assistance from the muscular coats of the uterus. The experimental studies of Wislocki and Guttmacher<sup>7</sup> have demonstrated in animals a definite and vigorous peristaltic activity on the part of the tubal musculature, the contraction waves passing from fimbriae to uterus. Only occasionally, even under the abnormal conditions of the experiment, was a slight wave seen going in the other direction. In the human a direct observation on this point was made by Hirschberg.<sup>8</sup> A specimen of tubal pregnancy, just removed from a patient, was placed upon a cold plate. Immediately those present observed a definite peristaltic wave passing from the fimbriated end to the uterine. This was repeated several times.

The most exhaustive study of this question is the very recent one of Kok,<sup>9</sup> whose material consisted of about 140 tubes from cows, sheep, and pigs. Among his conclusions the one which is pertinent to the present discussion is to the effect that peristalsis is almost exclusively toward the uterus, and that antiperistalsis is seen only as the result of a markedly distending foreign body in the ampulla.

Certainly the peristaltic activity of the tube is in no way comparable to that of the intestine. Every surgeon has frequently observed peristalsis in the intestine or ureter, but how many have seen any evidence of peristalsis in the living tubes at operation? So far as I know, no such observation has ever been made. It seems unnecessary to invoke the factor of tubal peristalsis to explain the propulsion of the tiny ovum through the tube. Indeed, the ovum is so small that a muscular contraction wave could hardly get a grip on it. The rôle of the cilia is probably a more important one in this connection.

In addition to the obstacle presented by the essentially one-way traffic through the tubal canal is the obstacle offered at the uterine end of the tube. The studies of Geist and Goldberger,<sup>10</sup> presented before this society last year, have a direct bearing upon this point.

They confirmed the observations of previous workers as to the extreme narrowness of this portion of the tube, the uterine orifice having a diameter often as small as 0.5 mm. and rarely more than 1 mm. Furthermore, this end of the tube is surrounded by a well-developed circular muscular layer, of almost sphincteric type. While this no doubt varies as to its tonicity or relaxation at different times, it seems incredible that it could admit such particles of tissue as, for example, are seen in some of my own sections. They could scarcely thread themselves into such a tiny orifice, especially when the relatively large uterine cavity offers a far easier way out. This is true even in the presence of such conditions as retroflexion or myoma, for I know of no evidence that with the great majority of these there is any great degree of obstruction to the egress of menstrual blood, as Sampson has assumed.

Again, even if particles of mucosa made their way into the tube, they would still have an almost impossible journey through the tubal strait. This, as Geist and Goldberger showed, is a very narrow canal which passes either in a gentle curve (40 per cent) or in an angulated or sinuous manner (60 per cent) through the thick musculature of the uterus.

In short, the tube may be likened to a long funnel. Its wide open mouth readily receives ova or other bits of tissue from the ovary, cancerous particles, etc., and carries them downstream into the uterus. It is not, however, so easy for particles to enter the extremely narrow neck of the funnel and to fight their way upstream to the peritoneal cavity. This essentially one-way mechanism may be looked upon, in part at least, as an agency to protect the peritoneum from intrusion from the outer world by way of the generative tract.

#### CAN ENDOMETRIUM THROWN OFF AT MENSTRUATION GROW ON THE OVARY OR PERITONEUM?

The effect of the obstacles encountered by tissue passing through the tube in an antiphysiologic direction upon the viability of such tissue must be borne in mind. In the first place, one must not forget that the tissue lost at menstruation has been thrown off to die. This is not a mere assumption, for if there is anything in the histologic interpretation of cell vitality, the fact can be abundantly established by histologic studies of menstruating uteri and of the cast-off tissue recovered from the menstrual discharge.<sup>11</sup> Even before the endometrial layers crumble away, their dissolution is evident from such changes as loss of staining reaction and obliteration of cell outline (Fig. 14). Autolytic changes must be quite active, for it is almost impossible to find more than an occasional indistinct clump of dead cells in the menstrual blood passed per vaginam. If the menstrual blood be taken from the interior of the menstruating uterus



Fig. 14.—Showing the endometrial surface on the first day of menstruation, with characteristic degeneration and crumbling away of the endometrium. It is hard to believe that these degenerated bits, even if they could get into the tube, could retain sufficient vitality after perhaps several days of travel to grow actively in the pelvis, especially when one considers the rapidity of autolytic changes in such tissue.

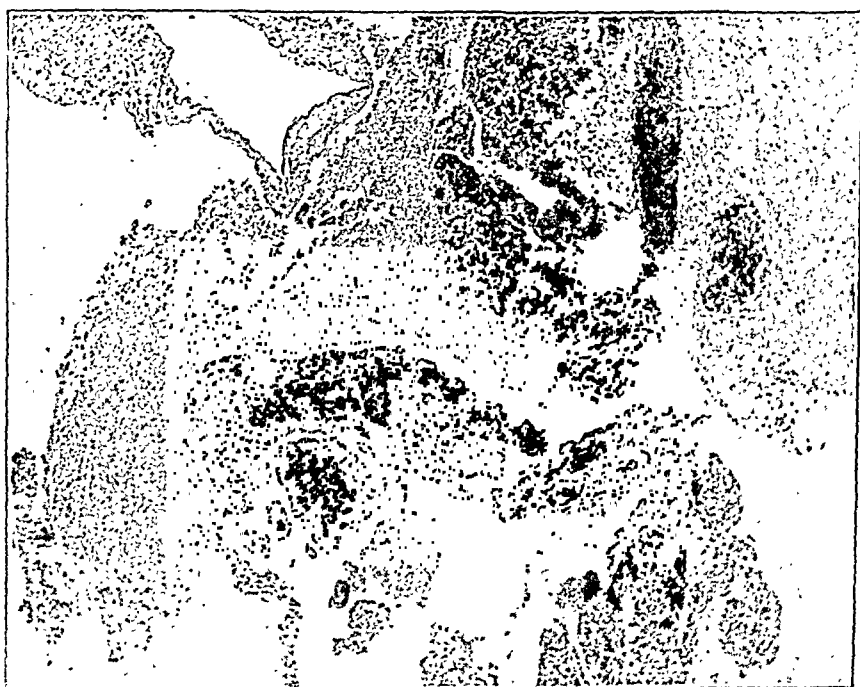


Fig. 15.—Particles of degenerated endometrium recovered from the uterine cavity, immediately after removal of the uterus, on the third day of menstruation. If histologic appearance is any criterion, as it usually is, they have little or no vitality left.

immediately after removal of the latter, somewhat less degenerated portions of tissue may be recovered (Fig. 15). Even at this point it would seem impossible for such dead or dying tissue to grow again. And yet we are asked to believe that such degenerate tissue somehow enters the tube, passes through it against the normal current, and makes its way to the peritoneum, where, in spite of probably many days of continuing degeneration and autolysis, it can still grow where it falls. The ovum requires at least several days for its passage through the tube, although it is much smaller than these supposed endometrial particles, and although it is helped by all the factors which retard the passage of the endometrial tissue.

The statement is commonly made that the ovary is especially suited to implantation of regurgitated endometrium, presumably because of the fact that the rupture of follicles offers ready portals of entry. But the follicles rupture not during menstruation but many days before this, most frequently on about the thirteenth or fourteenth day of the cycle. The area of rupture is soon sealed over, and the ovary observed at operation or studied after removal commonly presents a smooth surface. The question is not analogous to that of the implantation of gastrointestinal cancer on the ovary, for in the latter case we are dealing with a malignant tissue which is ever present and ready to graft itself upon the ovary when a portal of entry occurs.

As regards endometrium, it would seem that the delicate endothelium of the peritoneum would offer a far more inviting medium than the dense and relatively avascular albuginea of the ovary, with its covering of cuboidal epithelium. The fact that the ovary is by far the most common seat of heterotopic endometrium must therefore speak against the doctrine of implantation.

#### ECTOPIC DIFFERENTIATION OF CELOMIC EPITHELIUM AS A SOURCE OF ABERRANT ENDOMETRIUM

One of the most interesting observations in connection with the presence of endometrial tissue in the ovary is the fact that it exhibits so many variations in both its morphology and its reaction to the menstrual stimulus. One may find a broad expanse of the ovarian epithelium converted into typical uterine epithelium, not infrequently ciliated, with at times only an occasional gland-like invagination and perhaps no stroma whatever, i.e., in the sense of the typical uterine stroma. Such a surface may resemble endometrium of the fetal or infantile uterus. It may or may not show hemorrhage in the sub-epithelial layer. If it does not, it is often difficult to determine whether it is really to be spoken of as a müllerian type of epithelium. If it does, the suggestion of real endometrium is of course stronger. When a broad area of the ovarian surface is covered with a layer of the type described, with no tendency to penetrate into the ovary or



to grow above its surface, it is difficult to conceive of an implantation origin. The natural assumption would be that a metaplasia of the germinal epithelium has taken place, and that by a very easy and slight transition it has assumed a somewhat endometrial appearance.

In other areas we will see many glandular invaginations from such a surface, but without stroma and without any evidence of menstrual participation (Fig. 16). The general pattern of such pictures is so identical with that seen in the cases of unquestioned endometrial type, that one cannot escape the impression that we are dealing with exactly the same process, the only difference being that in the one instance the epithelium is quiescent and in the other it has, for some



Fig. 16.—Surface of ovary (beneath overlying adhesion), showing typical endometrial gland-like invaginations, with uterine type of epithelium, but no stroma and no evidence of menstrual reactivity. The gland epithelium is directly continuous with what is apparently a slightly modified germinal epithelium. It would seem that this picture represents exactly the same process as that described by Sampson, but in an earlier and less differentiated form. But it suggests a metaplasia, and not an implantation.

reason, acquired a sensitivity to the menstruation-producing hormone or hormones. The histologic picture in this group can scarcely be interpreted as one of simple germinal inclusion cysts of the type which one so often sees, especially in women at or near the menopause.

In still other cases the resemblance to genuine endometrium is much more clear cut, as a result of the presence of the characteristic stroma and perhaps because of the presence of what seems to be a menstrual reaction. At this point I may perhaps suggest that, in my judgment, Sampson has attributed too much importance to the significance of hemorrhage as a criterion of menstruation in ectopic endometrium.

It is important to remember that ovarian epithelium likewise exhibits what is to be looked upon as a normal hemorrhagic tendency. For example, it is normal for the lutein cell zone of the corpus luteum, during the vascularization phase, to exhibit hemorrhage into its cavity. This, of course, will rarely be mistaken for endometrial hemorrhage, but, after all, the lutein cells are merely modified granulosa cells, and the latter, in turn, are considered to be derivatives of the germinal epithelium.

To carry the derivation back even more ultimately, all these types of cells, i.e., germinal epithelium, granulosa cells, lutein cells, and endometrial cells, are descendents of the same mother tissue, i.e., the celomic epithelium. Hemorrhage in and about the graafian follicles, especially those which exhibit atretic change, is so common that it can scarcely be considered abnormal. Moreover, as I showed in a previous paper,<sup>12</sup> follicular hemorrhage originates in the sub-epithelial stroma, as with endometrial tissue in the ovary, and then breaks through the epithelium into the cavity. Indeed, some of the the pictures in Sampson's earlier papers seem to me to be more suggestive of follicular than of endometrial origin.

I mention these facts not to argue that Sampson's cases are of follicular or corpus luteum type, for this would be absurd. A proper question, however, would seem to be whether the blood in the lesions which he describes is always given off at the menstrual periods, i.e., synchronously with uterine menstruation. So far as I can recall, no one has described in the ovary a genuinely menstruating endometrium such as we see in the uterus, although it quite probably occurs. In a large number of cases the lesions show blood contained in cavities with intact epithelium, with no suggestion, even when they are removed shortly after menstruation, of the tissue loss and other changes which are so characteristic in the uterus. With so many deeply placed and essentially blocked-off cavities, one would surely expect to see occasional evidences of necrotic tissue elements, such as we find in the uterus, even allowing for rapid degeneration and autolysis. In the ovarian cavities they could scarcely disappear as quickly as they do in the uterus, which permits of prompt discharge to the exterior. In the ovary one most commonly sees blood elements alone, without such tissue changes, even when the ovaries are removed soon after menstruation.

As already stated, it is probable that in some ectopic endometrial islands the changes are identical with those seen in the uterus, but in a large proportion of them it would seem more likely that the bleeding is more closely allied with that seen in the ordinary follicle hemorrhage. Perhaps the bleeding is the result of the premenstrual congestion throughout the pelvic organs rather than of the actual rhexis and diapedesis which occurs at menstruation and which is

accompanied by loss of much of the mucosa. If the bleeding in ovarian endometrium is really menstrual, certainly the histologic reaction is very different from that seen in the uterus, both as to the actual stage of menstruation itself and also as to the regenerative process following the menstrual loss of tissue. In many areas the lining epithelium appears to be a transition between either germinal or follicular epithelium and genuinely endometrial epithelium. This would seem more logical than to say that the differences in the reaction are due to the age of the implants, even if these actually occur.

One often sees in the same ovary areas of endometrium actively responding to the menstrual cycle and, perhaps immediately adjoining them, islands of perfectly quiescent endometrium. Indeed, one often sees pictures which could be reasonably construed as evidences of endometrial transformation of the endothelium of the lymphatics. We have been much interested in this possibility, which I shall not, however, discuss in this paper.

The conclusion which suggests itself from this consideration of the hemorrhagic factor, and also the one which seems logical from a consideration of the differences in the histologic picture of the endometrium in perhaps different parts of the same ovary, is that we are dealing with one and the same tissue in different stages of differentiation, and that these stages are analogous to those seen in the developmental history of the generative epithelium.

It is the celomic epithelium, the covering of the primitive peritoneal cavity, that forms the various epithelia of the genital gland, the germinal epithelium, and indirectly the granulosa and lutein cells. Furthermore, it is this same celomic epithelium which becomes invaginated to form the lining of the müllerian ducts, so that the müllerian epithelium is really only a modified peritoneum. As a result of hormone influences concerning which we are as yet ignorant, this celomic epithelium assumes a different form in different parts of the tract. For example, in the uterus it assumes a gland pattern, more particularly after the onset of puberty, and develops a characteristic stroma. Physiologically, it possesses a remarkable sensitivity to the ovarian hormones.

In the tube, which is chiefly a transmitting organ, it has a more stable structure, characterized by such features as rugae, and absence of glands and stroma. It is not infrequent, however, to observe a confusion in the usually fairly sharp segmental differentiation. For example, I have, in quite a number of cases, seen a fairly typical endometrial mucosa in the fallopian tube at points quite removed from the uterus itself (Fig. 17). Others have made similar observations. For that matter, I have, in a certain proportion of cases, found ectopic mucosa in the ovaries to possess typically tubal features, without glands and without uterine stroma. It may even exhibit a definite

tendency to the formation of rugae. Such mucosa may be found in the interior of an endometrial cyst cavity. In one striking example, the cavity is lined by a mucosa which is definitely endometrial for a part of its extent and then passes rather abruptly into a just as typical tubal mucosa (Fig. 18).

Studies in comparative anatomy may throw some light on this point. Dr. Carl Hartman, of the Carnegie Institute of Embryology, tells me that he frequently finds abnormal epithelial outgrowths on the surface of opossum ovaries, of which he has studied some four hundred. The opossum ovary is not inclosed by the tubal sac, and there is no such thing as menstruation. I am indebted to Dr. Hartman for the two samples pictured in Figs. 19 and 20, which show on the



Fig. 17.—Section of tube wall (with some inflammatory change) showing resemblance to endometrial tissue. Characteristic uterine mucosa lining portions of the tube well removed from the cornu has been described by a number of authors.

surface of the ovary farthest removed from the hilum two aberrant growths, which, in Dr. Hartman's opinion, represent aberrant müllerian mucosa.

It would be just as useless to attempt to explain the reasons for this jumbling of the normal differentiation processes in the genital tract as it would be to offer an explanation for the normal morphologic and physiologic differentiation itself. It is almost certainly the result of hormone influences, and these affect chiefly or entirely the celomic epithelium in the genital gland area. More than this we cannot say. For this reason I do not feel that any one can, in the present state of our knowledge, explain the exact mechanism of production of aberrant mucosa. The celomic theory, which in one form

or another has been advocated by several authors (Lauche,<sup>13</sup> Robinson,<sup>14</sup> etc.), is therefore less a theory than a concept.

It is possible, as some have suggested, that the occurrence of ectopic endometrium at various points in the pelvis is due to the presence of celomic rests in these regions. But it is just as possible that, aside from the "rest" theory, the normal germinal or other epithelium of the ovary, or the normal pelvic peritoneum, may under the proper combination of endocrine and other conditions, be quickened to various differentiation phases abnormal for the tissue concerned.

This is no mere speculation, for embryologists, on the basis of careful observations, accept the view that there is a definite and intimate

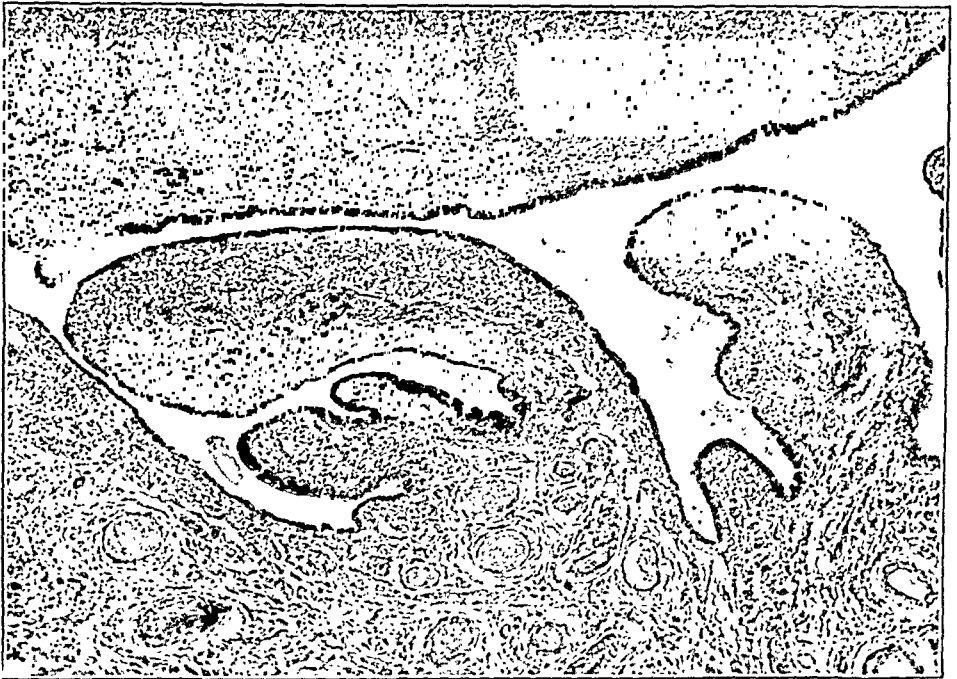


Fig. 18.—Wall of endometrial cyst in the interior of the ovary, showing endometrium-like portion of wall above, and typically tube-like portion below, one being continuous with the other.

relation between all the epithelial tissues arising from any one of the embryonic layers. Each one of the original embryonic layers possesses developmental potentialities, which, for various organs, are limited at various stages as a result of certain physical or chemical factors, either local or general. It thus is evident that the potency of the cells is not used up, so that if, in later life, the same conditions arise which are responsible for the original development of the cells in question, they may be activated into new growth. For example, a germinal epithelial cell retains a considerable degree of unused developmental potency, and with the proper activation, can develop further into an endometrial or tubal epithelial cell. The same statement may be made of the pelvic peritoneum. What the activating

conditions are we cannot say, except that they are almost certainly of endocrine nature. As already stated, these views are not merely speculative, for, as Fischel<sup>15</sup> has emphasized, they have considerable support from embryologic studies.

Applying this conception to the subject matter of this paper, one can readily understand why such an intimate relationship exists between the cells of the pelvic peritoneum, the germinal epithelium, the tubal mucosa, and the endometrium, for they are all descendents of a common mother tissue, the celomic epithelium of the urogenital folds. In this sense the endometrium and the endosalpinx are to be looked upon as merely a modified peritoneum, or a modified germinal epithelium, so that it is not so startling to think that either peritoneum



Fig. 19.—Abnormal outgrowth from the surface of an opossum ovary. It arises from the convex surface of the ovary, as far as it could well be from the hilum. Its structure resembles that of a tubal fimbria. For this section, and that illustrated in Fig. 20, I am indebted to Dr. Carl Hartman, of the Carnegie Institute of Embryology, who tells me that such abnormal outgrowths are not infrequent in the ovarian surface of these animals, which do not menstruate.

or germinal epithelium, plus the necessary but as yet unknown biologic activating stimulus, may give rise to more or less typical müllerian mucosa. It is possible that inflammatory or other disease of the pelvic organs may at times play some part in stimulating the ectopic differentiation of the reproductive epithelium, but this does not seem to me to be a very important factor. There is little real evidence in support of the view that inflammation, per se, can bring about an endometrial metaplasia of other pelvic epithelium, although it is possible that it may play a contributory rôle in some cases.

A consideration of possible importance lies in the fact that the activating hormones are probably found in the ovary itself, and that

the frequency of germinal epithelium metaplasia may perhaps be due to its proximity to the source of supply of the hormone—that perhaps there is a greater intensiveness of endocrine action in the ovary itself than in more distant tissues.

This conception of pelvic endometriosis explains all types and all locations of ectopic endometrium in the pelvic peritoneum, ovary, the uterine ligaments, the intestinal wall, the appendix, the abdominal wall, the umbilicus, the inguinal region, the vulva, etc., for in all these locations celomic tissue or remains may be found. This statement cannot be made of Sampson's theory of implantation from tubal regurgitation of endometrial particles, as will be emphasized later in this paper.



Fig. 20.—Another ovarian outgrowth from the surface of an opossum ovary. It is very similar to that shown in Fig. 19.

The theory of ectopic celomic differentiation, moreover, explains the frequency with which one finds, perhaps in the same ovary, all the developmental stages through which the genital epithelium passes—peritoneum, germinal epithelium, tubal mucosa, and endometrial tissue, either functioning or nonfunctioning.

The latter point, i.e., as to whether or not ovarian endometrium gives evidence of menstrual reaction, is one of especial interest. I do not agree with Sampson that this depends upon the age of the "implant." Very often nonreacting endometrium may be seen deep in the substance of the ovary, so that it can scarcely be considered "young," while superficially placed tissue may show definite menstrual reactivity. A clue as to the real reason for these differences

may be obtained from a study of the menstrual reaction of the uterine endometrium proper. Its upper layers, corresponding to the compact and spongy layers of the decidua, participate actively in the characteristic histologic changes of the menstrual cycle. The deepest layer, the basalis, is unchanged throughout the cycle, and it is from this layer that regenerative changes proceed when the upper strata are lost at menstruation. In the condition known as hyperplasia of the endometrium, the entire mucosa is made up of what is apparently an enormously overgrown basalis, as Martzloff and I have shown in a recent paper.<sup>10</sup> Such an endometrium shows no cyclic change, being stationary in structure. Polypi of the endometrium at times spring

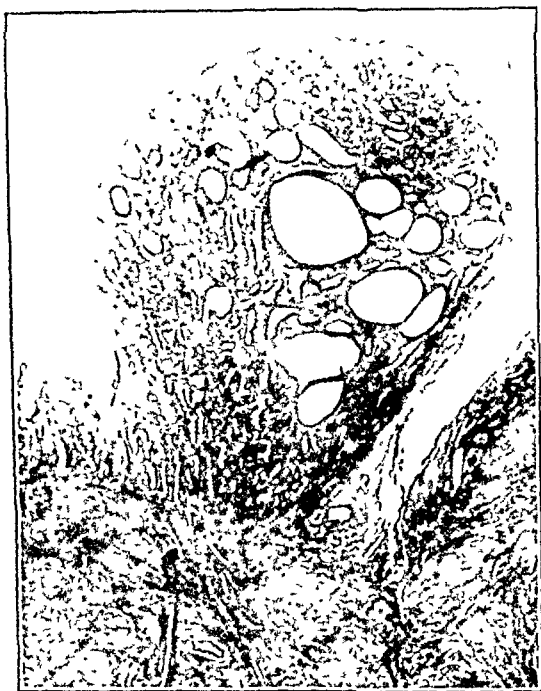


Fig. 21.—Uterine polyp with structure of functioning endometrium, showing same phase as latter. Such a polyp probably arises from the more superficial and functioning layers of the endometrium. This figure, and the one following, illustrate the stratum reaction of the endometrium, especially as regards menstrual reaction, hemorrhage, etc. This may explain some of the variations observed in endometrium as it occurs in the ovary.

from the basal layer, herniating through the upper functioning layers. Such polypi show the typical swiss-cheese pattern of hyperplasia, even though the endometrium proper exhibits a definite menstrual reaction (Fig. 21). They do not respond to the menstrual stimulus at all. Other polypi apparently arise from the functioning layers of the endometrium, and histologically exhibit the same menstrual phases as the latter (Fig. 22). In the same way, a downgrowth of uterine mucosa, as in the uterine type of adenomyoma, shows similar variations as to menstrual reaction. Some of the endometrial islets in the depths of the uterine wall show histologic pictures exactly corresponding to that seen on the uterine surface, premenstrual when the latter is



premenstrual, postmenstrual when the latter is postmenstrual, etc. Others, again, show a characteristic hyperplasia pattern, and several authors have called attention to the frequency of association of hyperplasia with adenomyoma. Such islands are explainable by the fact that they spring from the basal layer of the endometrium, just as do certain uterine polypi.

The endometrium is thus seen to possess a distinct stratum reaction, and this same stratum reaction is likewise evidenced in the ovary. Some of the ovarian endometrium, even when composed of typical epithelium and equally characteristic stroma, shows no evidence of functional response, even though near-by areas show marked

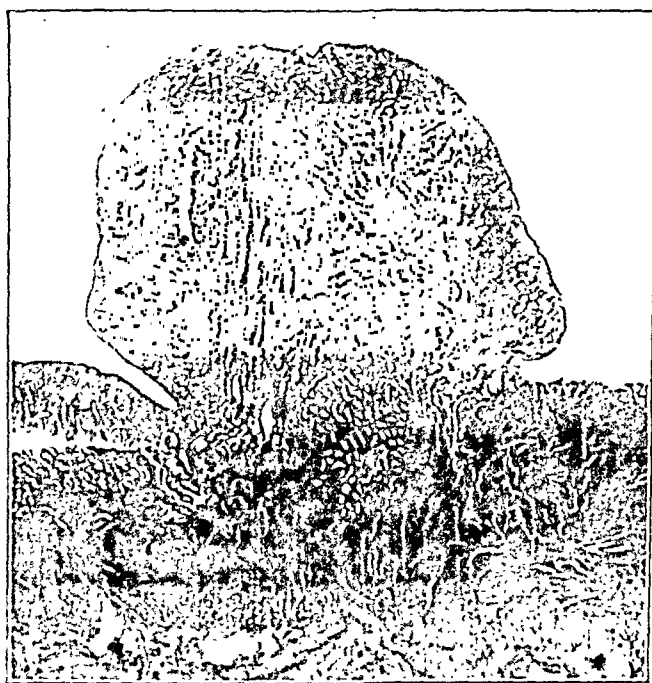


Fig. 22.—Uterine polyp presenting typical hyperplasia-like pattern, and probably springing from basal layer of endometrium. The remainder of the uterus shows usual cyclical changes, and menstrual history was normal. Polypi of this stationary structure are at times seen even when the remainder of the uterine mucosa shows a marked premenstrual hypertrophy.

menstrual reaction. In one remarkable specimen which I had the opportunity to study through the kindness of Dr. R. A. Watkins, of Portland, Oregon, a spongy mass of tissue removed from each ovary shows a uniform and extreme hyperplasia picture (Fig. 23). There is, of course, not the slightest suggestion of menstrual reaction, nor would any be expected. This case is interesting from another standpoint. If this hyperplastic endometrium had its source in a tubal regurgitation from the uterus, the mucosa of the latter would presumably have had the same structure. But hyperplasia of the endometrium is not associated with the monthly desquamative process which is supposedly necessary to liberate the particles into the tubes.

It presents a stationary picture, for no matter at what chronologic phase such an endometrium is removed, the picture is always essentially the same. Certainly there is no evidence of necrosis or surface loss of tissue. Unfortunately, no uterine tissue was available for study in this case. The presence of the endometrial hyperplasia in the ovaries of this case is not readily explainable on the regurgitation theory, unless one wishes to assume that the implantation had occurred a considerable time previously, and that the implanted endometrium then underwent hyperplastic transformation. This, of course, is theoretically possible.



Fig. 23.—A section from a spongy mass of endometrium removed from each ovary, by Dr. R. T. Watkins, of Portland, Oregon. Although the masses were large, they showed no sign of menstrual hemorrhage, nor would any be expected, as hyperplastic endometrium does not react to menstruation. Nor does it undergo periodic destructive change, so that the presence of this tissue in the ovaries cannot be explained on the tubal regurgitation theory, unless we assume that it became hyperplastic after implantation. This, of course, is theoretically possible.

The differences in the morphology and functional capacity of aberrant endometrium are, I believe, most plausibly explained upon the basis of differences in the degree of differentiation, remembering that endocrine factors may not only bring about segmental differences, but also stratum abnormalities, especially in the case of the endometrium.

One other point in this connection may be touched upon, for it has caused much discussion. I refer to the origin of the stroma (the "cytogenous" tissue of the German school). Not believing in the uterine origin of ovarian endometrium, I do not, of course, believe that the stroma of ovarian endometrium is bodily transplanted from the uterus by way of the tubes. It has always seemed to me that it

must be formed in situ. This is indicated by the fact that one can often demonstrate transition stages of one degree or another between the endometrial stroma and the native stromal cells of the tissue involved, as well as by the fact that perfectly characteristic stroma is to be seen in such distant locations as the umbilicus, where its origin by transplantation is not easily explainable.

The recent paper by Fischel, already quoted, while dealing with the relationships of epithelium and connective tissues in general rather than with the problem presented in ectopic endometrium, emphasizes a point of view which, to my mind, explains our problem logically and in conformity with our histologic studies. Fischel presents good evidence to substantiate his conclusion that developmentally the epithelium plays the dominant and formative rôle, the connective tissue the subordinate one. The stroma of the endometrium is to be looked upon as a satellite tissue and its appearance is the natural accompaniment of the presence of celomic epithelium which has reached a certain stage of differentiation.

#### DOES IMPLANTATION PLAY ANY PART IN PELVIC ENDOMETRIOSIS?

One of the strongest arguments brought forth by Sampson to support the implantation theory of pelvic endometriosis has been the fact that, in laboratory animals at least, endometrial tissue is capable of growth when transplanted to the pelvic peritoneum. The earlier experiments of Jacobson<sup>17</sup> upon this subject seemed to me rather unconvincing, and even his most recent work, which was done upon monkeys, cannot be taken as proof of the correctness of Sampson's theory. It is hardly necessary to emphasize the differences which exist between the sexual cycles of the lower animals and the human female. In none of them below the primates does menstruation occur in the sense in which we employ the term in the woman, although a number of them exhibit a periodic discharge of blood. This, however, commonly occurs during the period of proestrus and not during the period of actual sexual desire or estrus, as many appear to assume. Moreover, it is well known that the chronologic relation of ovulation to menstruation in the human is quite different from that which it bears to estrus in most of the lower animals which have been studied.

The most serious objection to the work of Jacobson and others who have studied endometrial transplantability in its application to pelvic endometriosis appears to me to lie in the fact that the tissue which they have transplanted is active, virile, and well-preserved, while the endometrial tissue thrown off in human menstruation is just the opposite, as I have already emphasized. If it were possible successfully to transplant to the ovary and peritoneum the degenerating endometrium of the menstruating uterus, the bearing of this method of study upon the problem would be much greater than it

now is. Even then, as we shall see, it would offer no proof of the hypothesis of tubal regurgitation. Such experiments are out of the question in the human subject, while heterotransplantation of human material into animals would offer little hope of success.

Tissue cultural methods, were they applicable to the endometrial tissue cast off at menstruation, would seem to be a desirable means of study, but they, likewise, as I am told by those more familiar than I with the technic, would be predestined to failure.

Even granting the essential applicability of Jacobson's studies to the human problem, what do they demonstrate? Only that endometrial tissue can be successfully implanted upon the pelvic peritoneum. They throw no light upon the source of the endometrium in human endometriosis. The arguments brought forth to fix the source as the uterus, by way of the fimbriated end of the tube, have to deal chiefly with the distribution of the "implants" in the pelvis. All of the evidence applies equally well—or better—to the ovary as a source of the dissemination. If the tube actually permitted a monthly regurgitation of blood and endometrium, it would seem that the pelvis of every woman with any ectopic endometrium at all would be filled with the tissue. Since the same conditions exist from month to month, the regurgitation would, according to this theory, also be regularly repeated. In view of the supposed proliferative tendency of the ectopic endometrium, one would expect extensive endometriosis in every case. This, of course, is not borne out by experience, for as a rule, the amount of ectopic tissue is very slight, the condition being often of no great clinical significance.

There are further facts which indicate that implantation alone can scarcely explain the origin or spread of the condition. The ectopic endometrium is not always situated at the points of predilection emphasized by Sampson. The relation of the tube to the ovary and of both to other pelvic viscera has always seemed to me to be much less stereotyped than one would gather from Sampson's diagrams. I have recently observed a case in which only one tiny endometrial islet was found in the pelvis, and that was on the anterior surface of the rectum, well above the level of the adnexa. Careful inspection of the ovaries, which were not removed, showed not the slightest suspicion of endometrial tissue. Another circumstance indicating that the abnormal tissue is not the mere result of gravitation of particles of endometrium from the tubal os to the most dependent parts of the pelvis is seen in the cases which have been reported by Keene<sup>15</sup> and others of extensive endometrial involvement of the vesicouterine pouch, or of the anterior surface of the uterus.

It must be remembered also that a tiny particle of tissue set free in the pelvis would not tend to sink like a ball of lead to the bottom of the pelvis or to the bottom of a hernial pouch. It would behave

more like a tiny feather and adhere to the first peritoneal surface with which it came into contact.

Pelvic endometriosis has been explained as analogous to cancer in its implantability on the peritoneum. But a pelvic cancer does not always confine itself to the pelvis. It is often soon disseminated throughout the abdominal cavity, vegetations extending over the whole parietal wall, the intestines, and often the stomach, liver, and other upper abdominal organs. This is never seen even with the most extensive pelvic endometriosis, which remains, to all intents and purposes, a strictly pelvic lesion. Mere peritoneal implantation, if concerned at all in the process, is certainly not the only factor in the spread of the condition. There must be some special susceptibility of the pelvic peritoneum to this endometrial implantation or differentiation, as the case may be.

As already stated, the evidence brought forth by Sampson in favor of the tubal dissemination theory applies even more forcibly to the ovary as a source of the dissemination. In other words, if implantation is an important factor—as it quite possibly is—it is more probable that the seed is dropped from the near-by ovary, with its better preserved endometrium, than from the end of the tube, which could transmit only a very degenerate tissue from the distant uterine cavity. In the case of the ovary, the tissue thrown off need not be the seat of menstrual degeneration. It may be actively growing endometrium which is thrown out by the rupture of hematmata, or which is broken off from the ovarian surface. A glance at Fig. 3 is rather suggestive in this respect. Would it not be easier for such polypoid outgrowths to break away from the ovary, even without the influence of menstruation, than for a portion of either menstruating or nonmenstruating endometrium to be separated by even the most violent pressure through the thick-walled uterus, as by bimanual examination, an occurrence which Sampson suggests as very possible?

The possibility of such a breaking off of ovarian endometrial tissue is well seen in Fig. 24, which shows a large particle of fairly well-preserved, nonmenstruating endometrium lying apparently free in an endometrium-lined cavity, which no doubt communicated from time to time with the general pelvic cavity.

The same reasoning applies to the supposed dissemination of uterine cancer through the lumina of the fallopian tubes to the ovary. My own impression is that this means of spread is of negligible importance, although the general implantability of cancer tissue is unquestioned. Cancer of the ovary is relatively rare as a complication of adenocarcinoma of the uterine body. Norris<sup>19</sup> found it in only 2 of 115 cases. When it does occur, it is far more logically explained as due to the generally recognized channels of dissemination, i.e., the lymphatics. Sampson argues that the rarity of ovarian metastasis is

explained by the accepted fact that fundal carcinoma most frequently occurs in women beyond the menstruating age. In quite a number of cases, however, adenocarcinoma occurs during the menstrual period of the woman's life. In Norris' 115 cases, for example, 15 were below forty years of age, and 18 were between forty and fifty. Most of the latter group were no doubt still menstruating, and yet only 2 of the entire series of 115, many of which he states were far advanced, showed extension to the ovary. The ages of these patients, and whether or not they were still menstruating, are not given.

In most cases of body cancer, the tumor mass bleeds rather constantly, simulating more or less the hemorrhage of menstruation. Fig. 25 is from an ovary removed with a uterus which was the seat of ad-



FIG. 21.—A particle of endometrial tissue cast off from and lying in the cavity of an endometrial cyst, which no doubt communicated with the exterior of the ovary. Endometrial tissue thrown off in this way from the ovary may make its way into the tube, or it may, conceivably, be implanted on the pelvic peritoneum.

vanced adenocarcinoma, with a long history of bleeding, at times very free. The interior of the uterus presented a fungating, foul-smelling, ulcerated mass of cancer tissue. No evidence of cancer was found in either ovary, but, as the illustration shows, definite endometrial tissue was found deep in the ovarian substance. I believe that the endometrium is present because it was formed in situ, during the woman's reproductive life, and that cancer was not found because it did not pass out from the uterine cavity, even though the latter was jammed full of it. It would not be logical to argue that the cancer closed the uterine orifices of the tubes, because such propinquity would seem to make it easier for bits of tissue to break away into the tubal lumina.

In one of his papers, Sampson presents illustrations of two sections in which cancer tissue is found lying free in the tubal lumen. But in both these cases cancer was present above the point at which the cancerous tissue was found in the tubal lumen. In one there was a cancer of the body of the uterus associated with a cancer of the same type in the distal end of the fallopian tube. The cancer particles were found in the tube between the tubal cancer and the uterus, so that it would be wholly unjustified to assume that they were passing out from the uterus instead of toward it, from the tubal cancer. His other case offers an exactly similar explanation. It was one of extensive disease of the uterus, which Sampson thought probably a coexisting adenocarcinoma and sarcoma. The pelvis was full of im-

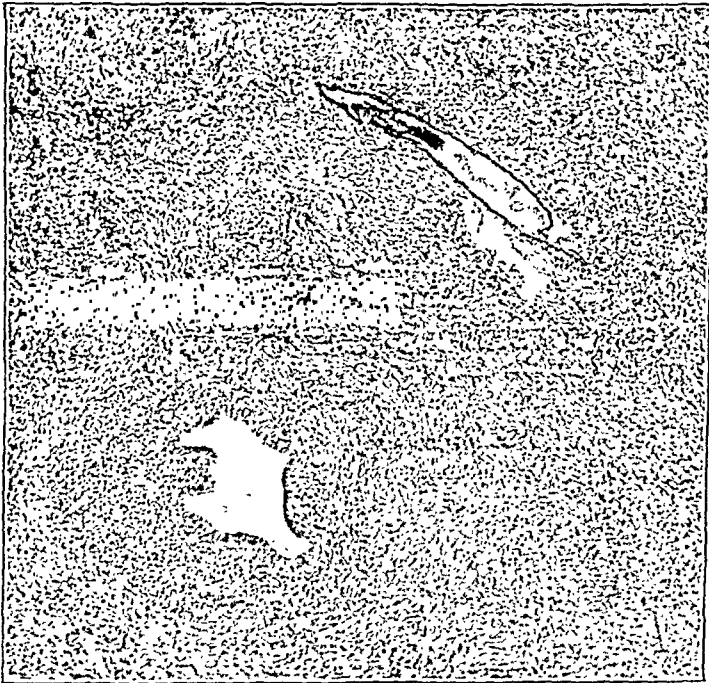


Fig. 25.—Section of ovary from a patient with extensive ulcerating adenocarcinoma of the uterus. No cancer is found in either ovary, but endometrium can be demonstrated. If endometrium could be transported, why not also cancer, when the uterus is filled with bleeding cancer tissue?

plantations, all of the supposed sarcoma type. Bits of growth, similar to the latter tumor, were found free in the lumen of one tube. In both these cases the tubes were patent, and I submit that there is no reason whatsoever for assuming that the tumor particles are migrating in the abnormal upward rather than in the normal downward direction.

Fig. 26 illustrates the findings in the tube of a recent interesting case. The patient had a right ovarian cyst about the size of a coconut. It was smooth externally, but its wall showed definite cancerous changes. The left ovary was normal, but the left tube showed a definite elongated nodule in its wall. It was evidently a cancer, and microscopically it showed a structure like that of the ovarian cancer.

The left tube was closed and the cancerous cyst showed no external growth, so that the tubal growth must have been due to lymphatic dissemination. Proximal to the tubal cancer, the lumen shows large fragments of cancer, but the uterine edometrium is perfectly normal, with no trace of cancer.

One other interesting group of cases may be very briefly alluded to—those of supposed operation scar implantation. A number of these have been reported, though this condition must still be looked upon as relatively rare. The reports of Heaney<sup>20</sup> and of Danforth<sup>21</sup> before this Society last year indicated that scarcely more than a dozen cases had been reported in the entire literature up to that time. Only a few have been reported since then.

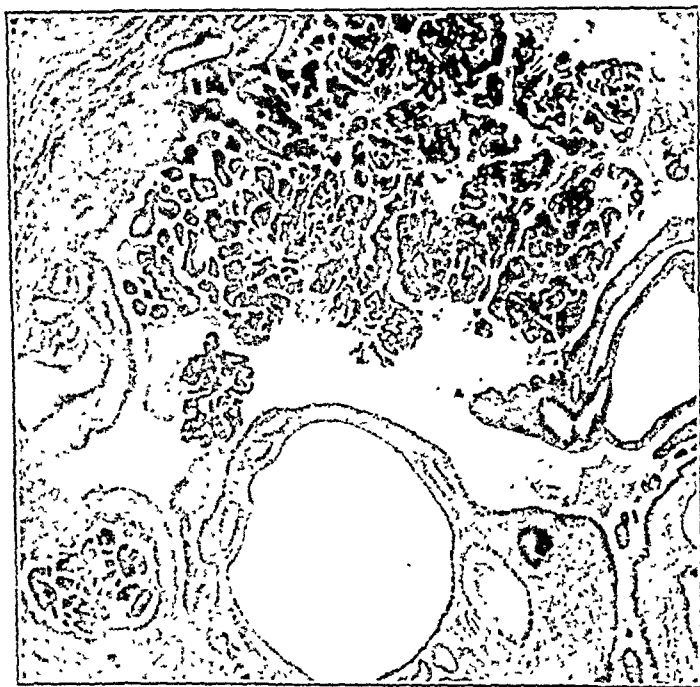


FIG. 26.—Tube showing large particles of cancer tissue in the lumen. The patient had a cancerous ovarian cyst on the right, although there were no external vegetations. The left ovary was normal, but the left tube wall showed an elongated nodule of carcinoma, presumably a metastasis by way of the lymphatics, as the end of the tube was sealed off. The large mass of cancer tissue shown in the lumen, exactly similar in type to that seen in the ovary, may be attached at some point to the tube wall; but it is easy to see how particles could break off and pass down toward the uterus. This is apparently borne out by the appearance of the smaller mass seen in the tubal alcove to the right. A uterine origin is excluded, for the uterine cavity shows no trace of cancer.

When the lesion occurs, it can scarcely be overlooked, for it often gives rise to much discomfort. Nor, in the past few years, is it apt to have been misinterpreted by any surgeon at all conversant with the literature which has been set in motion by Sampson's contributions. Hence the statement that it must be considered infrequent is justified, especially when one bears in mind the enormous number of operations performed each year in which the endometrial cavity is opened—hysterectomies, cesarean sections, etc. If these scar tumors



were produced by simple transplantation of endometrium, would we not be justified in finding them much more frequently than we do? Moreover, in an increasing number of cases, as in a recent one of my own, such endometrial tumors in abdominal scars are being reported in cases in which the uterine cavity is not in any way opened. Pan-kow<sup>22</sup> has recently briefly reported a case in which simple appendectomy had been performed upon the patient when she was a child, presumably before menstruation began. At the age of thirty a tumor developed in the scar, and on removal, ten years later, it contained typical endometrial tissue. I do not see how we can invoke the doctrine of transplantation in such a case. A number of other cases have been reported in which the uterine cavity was not opened at the original operation.

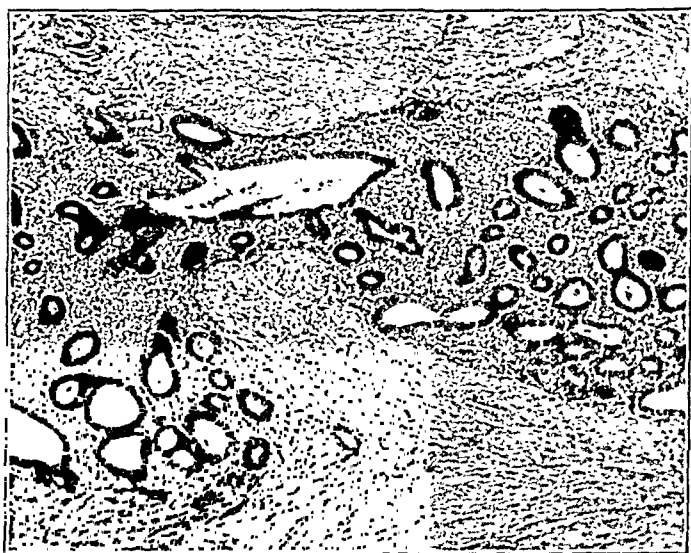


Fig. 27.—Typical endometrium in a nodule located in an abdominal cicatrix following an operation five years previously. This previous operation consisted in left salpingo-oophorectomy with pelvic drainage. The nodule was very tender, but the patient stated that there was no increase in size or in pain at the menstrual periods. It contained much endometrium, but practically all of it was of the quiescent, hyperplasia type seen above. Only a few glands were found to contain blood, and no chocolate areas were seen.

I do not believe that there is yet sufficient evidence for the assumption that these cicatrix endometriomas are due to actual transplantation of endometrial tissue, especially in the cases where the uterus is not entered at the operation. On the other hand, I do not believe that this possibility can be denied, especially as we are here dealing with a virile, well-preserved endometrium. The arguments which have been set forth in this paper appear to speak for the possibility of the origin of such growths from the celom-derived peritoneum, as with similar growths elsewhere on the peritoneum. Perhaps the irritative effect of the cicatricial process may play some part in stimulating this ectopic differentiation process. Even the umbilicus is, of course, to be looked upon as a cicatrix, while in addition it often

contains remnants of the omphalomesenteric duct, which is lined by celomic epithelium.<sup>23</sup>

It is interesting to note that the endometrium in these abdominal scars and umbilical tumors may show marked variations in morphology, as well as peritoneal, differentiation, such as were emphasized in the discussion of the ovarian lesion. For example, they do not always swell or cause increase of pain at the menstrual periods, as I had occasion to note in the recent case alluded to above (Fig. 27). In this case, the endometrium, while present in large amount, shows little evidence of existing or preexisting menstrual activity, although the growth had been present two years.

#### SUMMARY

The present study is based upon the histologic study of many hundreds of fallopian tubes, with particular reference to their contents. In seven tubes particles of uterine mucosa were demonstrated lying free in the lumen, and in one tube, which contained a pregnancy in its outer third, there was, between this point and the uterus, a mass of cells which resemble trophoblastic or possibly decidual cells. The nature of the endometrial particles, when these were found, is, I believe, indisputable in practically all the cases. None of the women from whom these endometrium-containing tubes were removed was menstruating, most of them being many days removed from this period. Five of the seven tubes containing endometrium were removed on the twenty-sixth, fourteenth, eighth, tenth, and ninth days of the cycle, respectively. In Case 2 there had been slight irregular bleeding for two weeks, but the endometrium was of the typical interval variety. In Case 7, in which tuberculous salpingitis was present, there is also said to have been a slight, dark reddish discharge for seventeen days. The uterus had not been removed in this case, so that we can say nothing as to its histology. In the cases in which the endometrium was available for study this was seen to be in a nonmenstruating phase, with an intact surface. In none of the cases did the endometrium in the tubes show the characteristic picture of endometrium thrown off at menstruation.

In at least five of the cases the particles of free endometrium are so large that it would seem almost impossible for them ever to have entered the tiny uterine orifice of the tube. The suggestion that they are probably moving toward rather than away from the uterus is strengthened by the finding of definite endometrial tissue in the ovary in at least two of the cases. The failure to find it in some of the other cases may be due in several instances to the fact that little or no ovarian tissue was removed at operation, and is possibly explained in one case by the frequent difficulty in finding small islands

of ovarian endometrium in specimens which have been in a fixing fluid for a considerable time.

*Does Menstrual Blood Regurgitate?*—A considerable number of observations (thirteen) in the course of operations upon women who were menstruating at the time and whose tubes were open failed to show regurgitation of menstrual blood in a single case. This experience corresponds to that of a number of other surgeons with whom the author has discussed the subject. Histologic examination of tubes removed during menstruation characteristically shows little or no blood. No blood has apparently been observed in the pelvis in the thousands of women operated upon by thousands of surgeons immediately after menstruation, although it could scarcely be resorbed so quickly if any had escaped into the pelvis. Even if occasionally blood did escape from the tube at menstruation, it is difficult to exclude pathologic lesions of the tube. If menstrual blood escapes into the pelvis, it is hard to see why it does not cause symptoms of peritoneal irritation similar to those seen with tubal abortion, or why it does not more often cause sealing off of the tubes. The latter are commonly open. The conclusion from these various facts is that although menstrual regurgitation through the tube may occur, it is exceedingly infrequent, too infrequent to explain such a very common lesion as pelvic endometriosis.

*Can Endometrial Tissue Undergo Retrograde Transportation into the Tube?*—The physiologic direction of travel through the tube is that taken by the ovum, i.e., from above downward. The ciliary current is probably more important than muscular peristalsis. Antiperistalsis is probably rare, and, according to recent investigations, occurs only in conditions of overdistention of the tube. The uterine orifice of the tube measures only 0.5 to 1.0 mm., so that it seems almost incredible that it could admit such large particles of tissue as are seen in some of my cases, especially with a far easier avenue of escape open through the uterus. There is no evidence that there is menstrual blockage in most cases of retroflexion or myoma, any more than it is now believed to occur with antelexion. Furthermore, endometriosis is often found with normal uteri. Even if an endometrial particle made its way into the uterine os of the tube, it would still have an almost impossible passage through the very fine lumen of the interstitial tube, which passes in a gently curved or sinuous fashion through the thick musculature of the uterus. The tube is to be likened to a funnel, whose wide mouth readily admits ova, endometrial or cancer particles, but whose narrow end and neck will neither admit nor transport them very easily.

*Can Endometrium Thrown Off at Menstruation Grow on the Ovary or Peritoneum?*—If it takes the smaller ovum a number of days, at least, to pass down the tube, even with the current at its back, it

would probably take much longer for tissue to pass upward against the stream, assuming that this were possible. But histologic studies show that the tissue thrown off at menstruation is dead or dying. Can such degenerative tissue thread itself into the tubal orifice, make its way upward against the obstacles which have been described, and, after probably many days, still have sufficient vitality to grow where it falls? This would seem incredible, especially as autolytic and degenerative changes are very rapid in the cast-off tissue of menstruation. There is no evidence that the ovary, except at the time of ovulation, offers any especial portal of entry for "implantations"—and ovulation is almost as far removed from menstruation in point of time relation as it can be. At other times the ovary is commonly smooth, with a dense fibrous albuginea covered by the cuboidal germinal epithelium. And yet, although theoretically less favorable from this standpoint than peritoneum, it is much more commonly the site of "implantations." Indeed, Sampson suggests that it acts as a sort of intermediary host. For the reasons I have just mentioned, it would seem that the susceptibility of the ovary to endometrium-like transformation must be explained in some other way than upon the basis of simple implantation.

*Ectopic Differentiation of Celomic Epithelium as a Source of Aberrant Endometrium.*—If aberrant endometrium is not derived from the uterine mucosa by transportation through the tubes, what is its source? No one can speak dogmatically on this point in the present state of our knowledge, but I have offered evidence in support of the view that the explanation may perhaps best be sought by reference to the normal developmental history of the genital epithelia. All are derived from the celomic epithelium of the urogenital folds. Not only does this form the germinal epithelium of the ovary and the follicular epithelium, but it also becomes invaginated to form the lining of the müllerian duct. The endometrium and the endosalpinx are therefore to be looked upon as mere modifications of the peritoneum. It is therefore not surprising that either peritoneum or germinal epithelium may at times show endometrial transformation. The factors which determine the normal regional differentiation of the celomic epithelium are as yet unknown, though almost surely of endocrine nature. It is a well-known embryologic law that tissues derived from the same embryonic mother epithelium are closely related. Furthermore, the developmental potentialities of celomic epithelium which has reached the stage of germinal epithelium are not used up, to apply the embryologic generalization laid down by Fischel. It is still capable, with the proper activating influence, of going on to further differentiation into endometrium or endosalpinx.

This idea is borne out by the fact that one may see in ovarian endometriosis all the stages of differentiation through which the genital

epithelium normally passes, e.g., simple endometrium-like epithelium with few or no invaginations and little or no stroma; more typical endometrium with or without menstrual reactivity; mucosa resembling that of the tube, etc. The mere presence of hemorrhage cannot be taken as evidence of menstrual participation of epithelium. Other epithelia in the ovary, as I have indicated, show a physiologic hemorrhagic tendency. The various histologic pictures mentioned above as occurring in the ovary are probably different stages of the same process, representing merely different stages of differentiation, both morphologic and functional, as I have discussed in this paper. A possible factor in the activation of germinal epithelium is the fact that the hormones of the ovary itself are probably the ones most concerned, and that they exert a much more intensive influence upon the local ovarian tissues than upon more distant ones.

The above ideas as to the origin of aberrant endometrium are offered as a concept rather than an explanation of the lesion. Until we know more about the normal processes of development we shall probably be unable to explain this abnormal condition with any precision.

*Does Implantation Play Any Part in Pelvic Endometriosis?*—The studies of Jacobson would seem to indicate that in animals endometrium can be made to grow on the peritoneum, but they throw no light on the source of aberrant endometrium in cases of pelvic endometriosis. The significance of this work is lessened by the fact that the endometrium transplanted was active and virile instead of degenerated, as in the case of the menstrual endometrium in women.

Against the all-importance of implantation in the dissemination of endometrium in the pelvis, several facts may be mentioned: (1) The endometrium is not infrequently found chiefly, and perhaps exclusively, in parts of the pelvis, or elsewhere, where implantation from the tube would not be easy; (2) it is often present in extremely small amount, in spite of the supposed monthly regurgitation and the proliferative tendency of the tissue; (3) it is characteristically confined to the pelvis, even when extensive endometriosis is present, unlike cancer, which can implant itself over the entire abdominal cavity. All in all, the evidence indicates that if implantation plays a part in the dissemination of the endometrium, as it well may, it is the ovary from which the seed is primarily dropped rather than the tube. All the reasons urged by Sampson in favor of the tubal origin of "implants" speak just as forcibly, and indeed much more so, for the ovary as the primary source. Endometrial tissue from the ovary would theoretically possess much greater vitality than that from the menstruating uterus, for it could readily break off from the surface or be cast out in the rupture of hematomata, without the influence of menstruation.

No evidence which has yet been advanced would seem to demonstrate that retrograde transportation of cancer particles from the uterus is a factor of any great importance in the explanation of ovarian metastasis in adenocarcinoma of the fundus. The complication is very infrequent. The two cases in which Sampson found cancer particles in the tubal lumen have no significance in this connection, because in each case there was a cancerous growth above the free tubal particles, which were thus probably making their way from the growth toward the uterus. I have reported a similar case in this paper. This, at any rate, is the natural assumption, and the burden of proof would seem to be placed upon those who presuppose such an unnatural and difficult-to-explain process as retrograde transportation of tissue from the uterus.

The cases herein reported of endometrium passing through the tubes, as well as all the others in the literature, show a nonmenstruating endometrium which is explainable in only one of two ways. It may be passing from the ovary to the uterus, as I believe is indicated by some of my own cases and also by the single case which Sampson pictures in one of his articles. If, on the other hand, it is being transported in a retrograde manner, certainly this migration has nothing to do with menstruation in these or in any other cases which have been reported in the literature. It would have to be explained as due altogether to such factors as the squeezing of the uterus at operation or examination. But I do not believe that anyone would attempt to explain in this way more than a very small proportion, if any, of the numerous cases of endometriosis encountered clinically.

I should like to acknowledge my indebtedness to Drs. Thomas S. Cullen, George L. Streeter, and Carl Hartman, for valuable suggestions. The photomicrographs are the work of Mr. Herman Schapiro.

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26 EAST PRESTON STREET.

(For discussion see page 623.)

## A CONTRIBUTION TO THE STUDY OF ENDOMETRIOSIS\*

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THE purpose of this report is to place on record nine cases of heterotopic endometrial tissue, some of which illustrate the possible origin and mode of production of certain endometrial implants. Sampson, Graves, Cullen, Danforth, Heaney, Keene and Norris have reported before the American Gynecological Society the finding of endometrial-like tissue in all of the pelvic organs, along the intestinal tract, and in the postoperative scar of the abdominal wall following operations in which the uterine cavity was opened. Many others have reported similar findings.

The frequency of this condition is not generally appreciated by surgeons because the lesions, especially the smaller ones, are not recognized. Sampson, who is looking for these implants in every pelvis, found them in 98 out of 332 operations for pelvic disease in a single year. Thus far the symptomatology and preoperative differential diagnosis has not been established, and the students of the subject are not agreed regarding the origin of some heterotopic endometrial tissue. Our series, while small, is offered with the hope that it will aid in establishing endometriosis as a clinical entity and in the admission that minor pelvic manipulations or operations may at times be responsible for its occurrence.

### ENDOMETRIAL IMPLANTS PROBABLY DUE TO TRANSUTERINE INFLATION

The following case is believed to be of more than usual interest.

CASE 1.—Mrs. A. H., aged twenty-nine years, was first seen by C. H. D., February 2, 1925. She complained of sterility, dysmenorrhea, lumbosacral backache, bearing down sensations and moderate leucorrhea. Her periods were regular 25 day type, lasting 6 days with moderate pain which was worse on the second day. Her appendix had been removed in 1916. In January, 1924, a glass tube had been inserted after a dilatation and curettage, but as she did not become pregnant other physicians inflated the tubes in April and October, 1924, and in January,

\*Read at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 21 and 22, 1926.

1925. Through a misunderstanding the last inflation was done seven days after the beginning of the period instead of seven days after it stopped. Each time the gas passed easily according to reports.

Examination showed that the uterus was sharply retroflexed and low in the pelvis. The adnexa were prolapsed into the culdesac. The cervix showed chronic endocervicitis and moderate erosion. The cervix was cauterized, the uterus replaced and a suitable pessary inserted.

The cervical condition healed within six weeks. She was relieved of most symptoms within a few days after the first examination and treatment, but when the pessary was removed the retrodisplacement promptly recurred and with it the pelvic discomfort and backache. She finally agreed to operation in October, 1925.

*Operative Findings:* The tip of each tube was adherent to the uterosacral ligament on its side. On freeing these adhesions there remained granular-like tissue along the area of adhesions which resembled bits of endometrial tissue (Fig. 1). These were removed, leaving an oozing peritoneal surface. The lumen of the tubes appeared larger than usual, and the ovaries were apparently normal.

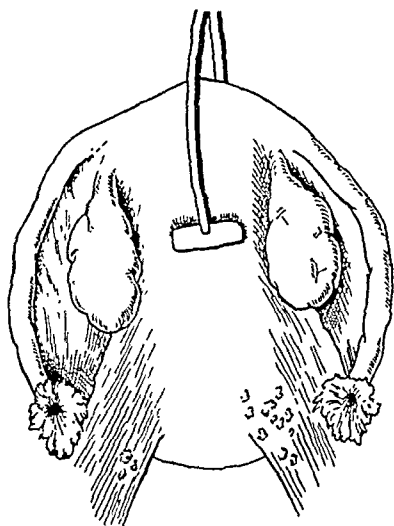


Fig. 1.—Case. 1. Tip of each tube found adherent to uterosacral ligament on its side. Granular-like tissue found along area of adhesions at base of uterosacral ligaments.

*Pathologist's Report:* The sections show many small pieces of tissue having typical structure of hyperplastic endometrium. Some of the glands contain blood and degenerated blood, others a homogeneous material, and a few are filled with polymorphonuclear leucocytes (Fig. 2).

The most interesting part of this record is the treatment which she had for sterility, and the fact that the third inflation was done the morning after the cessation of menstruation. Accepting Sampson's observations and Jacobson's experiments on rabbits as proof that many endometrial implants are the result of normal endometrium escaping through the tubes, this case illustrates three possible etiologic factors. First, by an increased intrauterine pressure during menstruation in the presence of retroflexion with or without a tight internal os, droplets of blood and endometrial tissue are forced through patent tubes, as has actually been observed by Sampson. This possibility is supported by the work of Novak and TeLinde which showed that the endometrium is cast off in strips and bits during the





Fig. 2-A.



Fig. 2-B.

Fig. 2.—Case 1. *A* and *B* (x 25) show size and type of the granular tissue which was removed. *C* and *D* show higher magnifications. This tissue is typical of endometrium and is believed to have been forced out through the tubes during a tubal inflation. (See *C* and *D* on next page.)

first few days of the menstrual period. Second, tissue is forced through tubes by manual manipulations of the uterus at the end of menstruation, or following intrauterine manipulations, such as dilata-

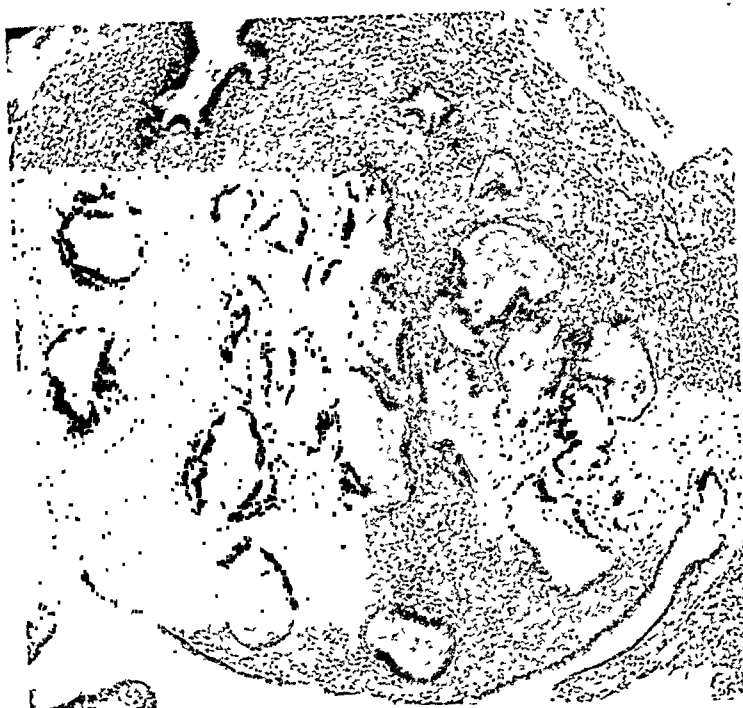


Fig. 2-C.

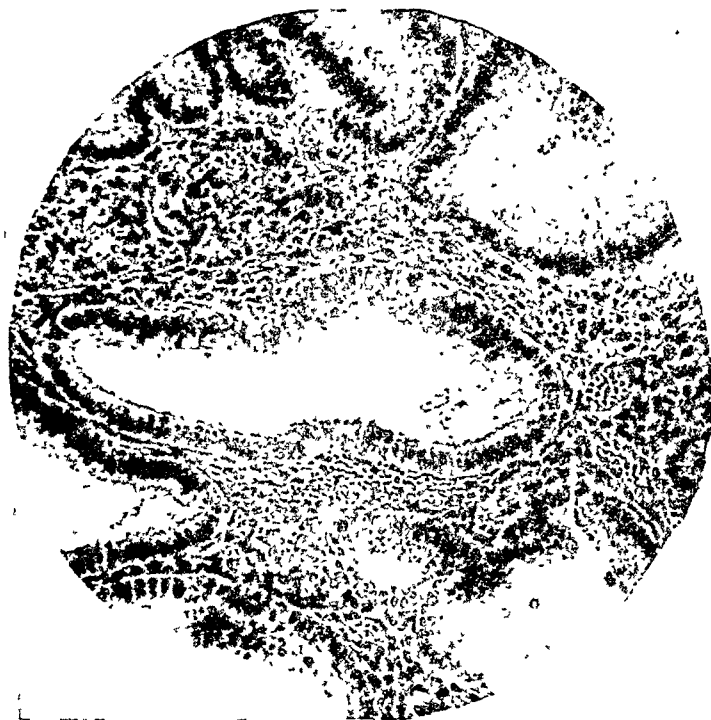


Fig. 2-D.

tion and curettage; and thirdly, by the injection of air or carbon dioxide through the uterus and out the tube or tubes. One of us (R.S.C.) has actually seen droplets of bloody fluid forced out of the fimbriated end of the tube during a laparotomy when carbon dioxide

was being introduced according to the Rubin technic. In the above case it is possible that bits of free endometrial tissue remaining in the uterus, or dislodged by the intrauterine cannula, may have been forced through the prolapsed tubes and grafted onto the peritoneum along the attachments of the uterosacral ligaments.

#### ENDOMETRIAL IMPLANT INVOLVING POSTERIOR VAGINAL VAULT

CASE 2.—Mrs. T. A., aged thirty-eight years, was first seen by R. S. C., September, 1925. Menses had always been scanty. Following an anterior shortening of the round ligaments, in 1915, she became pregnant but aborted at two months. In

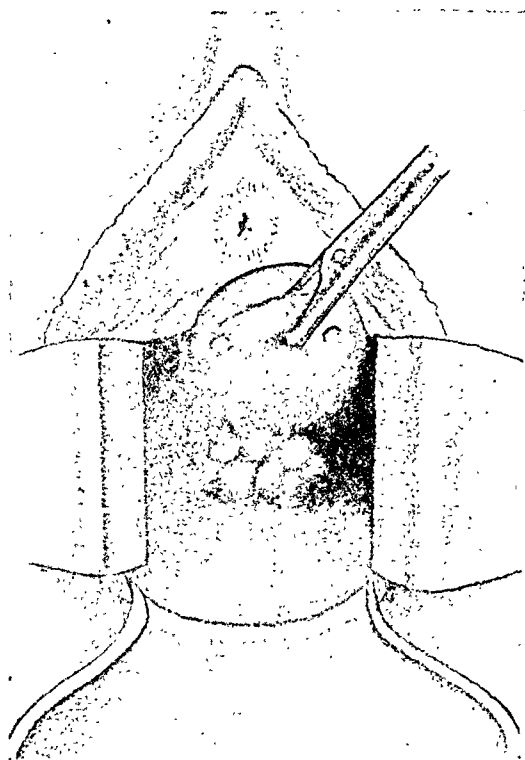


Fig. 3.—Case 2. Blue dome cysts (endometrioma) of vagina just posterior to cervix—filled with chocolate-colored material and surrounded by considerable induration which extended into the posterior culdesac.

1918, she had amenorrhea for four months before an attack of influenza. Following this illness the periods were very profuse. At that time the late Dr. Studdiford cauterized some Nabothian cysts on the cervix and treated her for anemia. She enjoyed good health during the next six years. Late in 1921, she developed pain in the vaginal vault during coitus. A few months later she began to have more profuse periods with the recent development of flooding and large clots. There has been nausea but no pain with the menses.

Pelvic examination showed that the cervix was conical in shape, pointed posteriorly and its mobility definitely restricted by a moderately tender, indurated mass the size of a hickory nut, just posterior to the cervix in the posterior fornix. This area could not be visualized with the speculum, but manipulation caused bleeding, and a tentative diagnosis of carcinoma of the vagina was made and radium treatment advised.

The induration was confirmed when the patient was examined under anesthesia, and just posterior to the cervix, six or eight small bluish cysts were seen in the vaginal wall (Fig. 3).

*Operation:* The curettings were normal. Incision of the cystic areas in the posterior fornix of the vagina showed them to be filled with a chocolate colored material. Rather active venous bleeding necessitated suturing. In view of the history of menorrhagia and the location of the lesions which were then recognized as blue dome cysts (endometrioma) 100 mg. of radium in the form of needles in the cysts and a capsule in the cervix were left for a total of 2150 mg. hr.

Microscopic examination of the tissue removed from the cystic area showed no malignancy but a typical endometrioma (Fig. 4).

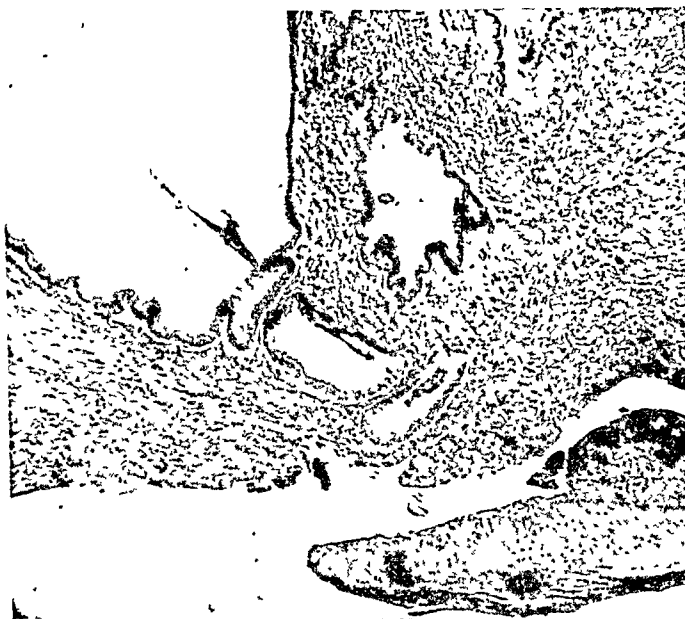


Fig. 4.—Low power microphotograph of blue dome cyst (endometrioma) as shown in Fig. 3 (Case 2). Normal squamous cell mucous membrane of the vagina is present except over the cystic area where the cyst wall approaches the surface. The cyst is lined by ciliated columnar epithelium as are a number of the other gland spaces, all of which are surrounded by typical endometrial stroma. Some of the gland-like spaces contain blood and a homogeneous material. The patient also had a chocolate cyst of the right ovary.

Examination of this patient six months after radium treatment showed a slight slough on the posterior lip of the cervix and considerable shrinking of the lesion. There has been a continuous slight discharge and recently a small amount of bleeding.

In a discussion before the American Gynecological Society last year, Cullen described a case in which the gross appearance was similar to this one. The cases of vaginal endometriosis studied by Sampson were all located in the vault of the vagina posterior to the cervix, and were directly continuous with a peritoneal endometriosis in the posterior culdesac. In this case it is our belief that the growth started as an endometrial implant on the peritoneum of the culdesac. (Since this paper was written, her abdomen was opened and a chocolate cyst of the right ovary found.)

## ENDOMETRIAL IMPLANTS ON UTERUS

CASE 3.—Mrs. M. H., aged thirty-five years, was first seen by C. H. D., December 31, 1925. Her chief complaint was dysmenorrhea which kept her in bed from one to three days each month and was only relieved by hypodermics. There had been more or less pain since her first period, but it had become much more severe during the past two years. An acute appendix and the left adnexa had been removed in 1912.

*Operative Findings:* The omentum is adherent along the old incision and over the top and right side of the uterus. The uterus is irregularly enlarged with multiple fibroids. The left adnexa are missing. There is a tuboovarian abscess on the right side. Operation: Freeing of omental adhesions, subtotal hysterectomy and right salpingo-oophorectomy.

*Pathologic Examination:* The uterus contains an intramural fibromyoma about 6 cm. in diameter in the posterior wall and several smaller ones are scattered through the musculature. Along the line of omental attachment are seen two puckered areas about 2 cm. long and 1 cm. wide. These apparently penetrate to a depth of about 1 cm. The uterine cavity shows no gross pathology. The tube and ovary make a single mass about 10 cm. long and 5 cm. wide and show a typical picture of tuboovarian abscess.

*Microscopic Examination:* Sections from three blocks of uterine wall near serous surface in puckered areas show typical endometrial tissue. Sections of the ovary show subacute inflammation. Sections of the fibroid show typical picture of fibromyoma. No evidence of endometrial tissue is found in any of the sections taken from the ovary.

## CHOCOLATE CYSTS OF THE OVARY

Five patients had chocolate cysts of one or both ovaries. Their histories and findings are briefly recorded.

CASE 4.—Miss E. B., aged forty-six years, was first seen by C. H. D., September 18, 1922. Her chief complaints were frequent profuse periods with tendency to clots, severe dysmenorrhea, attacks of right sided pain and moderate leucorrhea. Recto-vaginal examinations: Uterus is markedly retroverted, moderately enlarged and nodular. Left adnexa negative to palpation. The right adnexa are enlarged and tender.

*Operative Findings:* On opening the abdomen the omentum is found attached to the anterior right wall of the abdomen along the line of Poupart's ligament with dark areas and the appearance of a mass under it. On separating the omentum it is found that the right round ligament is involved in the right sided mass which apparently developed from the spill of a chocolate cyst of the right ovary. The sigmoid and ileum are attached by firm adhesions to the pelvic mass. The entire right pelvis is filled with a tuboovarian mass and attached to the wall by dense adhesions. The uterus is small, retroverted and contains multiple small fibroids. The left ovary is enlarged and contains cysts. There are old adhesions in the upper abdomen. The gall bladder is markedly distended and does not empty on pressure. The kidneys are normal to palpation. The appendix is thickened but free from adhesions. Operation: Freeing of omental and intestinal adhesions, panhysterectomy, appendectomy, repair of injured areas in bowel wall, ignicauterization of chocolate areas on intestines, and plastic covering of the raw pelvis with the sigmoid. Two weeks later the gall bladder was removed. The microscopic examination showed typical endometrial cysts of the ovary. The patient made an uneventful recovery and is now in good health.

CASE 5.—Miss E. K., aged forty-seven years, was first seen by C. H. D., June 18, 1924. Her first period at the age of fourteen was so painful and profuse that the foot of her bed had to be elevated. She always had to remain in bed one or two days, and as she grew older the periods became profuse to the point of real hemorrhages. She began to flow April 29, 1924, and with the exception of two weeks had a daily flow until the time of operation. The preoperative diagnosis based on history and pelvic findings was probable chocolate cysts of ovary and adenomyomata of the uterus, with secondary anemia.

*Operative Findings:* The uterus contains multiple small fibroids. Both ovaries are enlarged and contain typical chocolate cysts. The left ovary is about three inches in diameter. There are dense adhesions between the ovaries and the uterus. The rectum is adherent to the lower portion of the uterus. The culdesac is obliterated by dense adhesions. Operation: Subtotal panhysterectomy, appendectomy, and plastic covering of the pelvis with the sigmoid to prevent adhesions between the small intestines and the raw pelvis.

*Microscopic Examination:* The sections of the ovary show typical findings of chocolate cyst of the ovary and that from the adherent parts of the uterus also shows typical endometrial tissue. This patient made an excellent recovery, and there was a gradual atrophy of the thickened area where the rectum was adherent to the cervical portion of the uterus.

CASE 6.—Miss E. M., aged forty-five years, was first seen by C. H. D., July 22, 1925. Her only complaint was enlargement of the lower abdomen. The uterus was enlarged by a fibroid tumor which filled the pelvis and extended upwards to the navel.

*Operative Findings:* Large pedunculated fibroid of the uterus with twisted pedicle and secondary adhesions to the rectum and sigmoid, multiple small fibroids of the uterus. The right ovary contains a typical chocolate cyst, and there is a right sided parovarian cyst 5 by 7 cm. in diameter. Operation: Subtotal panhysterectomy and repair of injured bowel. She had a smooth convalescence and with the exception of hot flashes has enjoyed good health since the operation.

CASE 7.—Miss P. M., aged forty-six years, first seen by C. H. D., March 29, 1926, because of moderate menorrhagia and metrorrhagia since September, 1925. Her periods began at the age of 15 and had been regular 28 day type, lasting five to six days until the beginning of the present trouble when she began to bleed on alternate weeks. They were painful from the first, but for some years the pain had not been as regular and was usually less severe. Operation was advised because of pelvic findings and history.

*Operative Findings:* The uterus is retroverted and contains small intramural fibroids. The left adnexa are prolapsed into the culdesac and the left ovary, which is enlarged to about 5 by 6 cm., is held by dense adhesions. The right adnexa seem normal. The appendix is thickened but free. Examination of the upper abdomen is negative. Operation: Panhysterectomy and appendectomy. In freeing the left ovary the chocolate cyst was ruptured. It was found that there were secondary implants which involved the rectal wall extending moderately into the rectovaginal septum. Palpation of this area on rectal examination led us to suspect the true nature of the condition before operation. No attempt was made to remove the tissue from the rectal wall as our experience agrees with that of Graves and Sampson that these areas atrophy after the ovaries are removed. The sections from the wall of the ovary show typical endometrial tissue.

CASE 8.—Mrs. A. S., aged twenty-two years, first seen by C. H. D., March 5, 1924. Chief complaints were sterility and dysmenorrhea. The pain starts before the onset of the period and lasts until after the flow stops. This has been much

worse since an appendectomy in 1922. At operation it was found that the enlargement of the ovaries was due to bilateral chocolate cysts. Both ovaries were resected and the left tube removed. Her condition was improved, but within a year she reported painful and prolonged menstrual periods. Her present condition is not known. The sections of tissue from both ovaries show typical endometrial tissue.

#### ENDOMETRIOMA POSSIBLY OF EMBRYONIC ORIGIN

CASE 9.—Mrs. J. E. R., aged thirty years, was operated in September, 1924, by R. S. C., because of a retroversion with prolapsed and adherent ovaries. The uterus and ovaries were found to be fairly normal in gross appearance, but on the left tube a bluish-colored rounded area about  $\frac{3}{4}$  cm. long and  $\frac{1}{2}$  cm. wide was discovered on the median surface at about its middle. Believing this to be an endometrioma the tube was resected and the tissue examined. The sections show typical endometrial tissue on the wall of an otherwise normal tube. There is no



Fig. 5.—Case 9. Low power microphotograph showing heterotopic endometrial tissue in the wall of an otherwise normal fallopian tube. Some of the gland-like spaces contained red blood cells. Serial sections showed no connection between the lumen of the tube and the gland spaces. This is possibly of embryonic origin.

evidence found in serial sections of a connection between the lumen of the tube and the heterotopic endometrial tissue, and the peritoneum was apparently intact on the peritoneal side. (Fig. 5.)

The ovaries were not available for microscopic examination but they did not show any macroscopic lesions suggestive of endometriomata. Last year Sampson stated that he had "strong presumptive, almost positive, evidence that benign endometrial tissue at times metastasizes through the lymphatics." While the possibility of such an origin cannot be eliminated in this case it seemed probable to us that it developed from a remnant of embryonic müllerian duct. Dr. Sampson, however, has examined the sections and believes this endometrioma started as an implant on the tube with subsequent growing over of the peritoneum.

The association of fibromyomata with heterotopic endometrial tissue has been rather constant in the older women in our small series. We have noted this association in a goodly number of the cases re-

ported by Sampson and others. It is possible that there may be some relation between disturbed function of the ovary and the development of fibromyomata. The sterility which is so common with both fibromyomata and endometriosis may be due to an abnormal condition of the ovaries rather than to obstruction of the tubes.

In a study of the menstrual histories of these cases one must be impressed by the fact that the periods have been painful from the first in an appreciable number. This may prove an important fact in the final analysis of etiology. It may eventually be shown that certain ovaries contain rather large embryonic inclusions of endometrial tissue which caused pain from the first period and eventually resulted in chocolate cysts. The spill from such cysts could lead to the development of secondary growths in the culdesac or on the uterus. It is also possible that the pain of the first period may have resulted from a very tight internal os and that this associated with a possible congenital retrodisplacement of the uterus resulted in the escape of endometrial tissue through the tube and the subsequent growth in a recent corpus luteum with the later formation of chocolate cysts.

A careful study of our findings and the literature on endometriosis has led us to agree with those who believe that at present no one theory will explain all. In our first case there can be no question that the tissue removed from the uterosacral ligaments was transplanted uterine mucosa. Sampson has many cases in which the transplant theory cannot be questioned, and we accept his observations as evidence that most endometriomata are transplants derived originally from uterine mucosa. In many instances, however, it may be impossible to prove that the primary endometrioma started from an embryonic inclusion or from transplanted uterine mucosa. The end-results may be the same.

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## THE RELATION BETWEEN THE TREATMENT OF CANCER OF THE CERVIX AND THE CELL TYPE\*

BY FRANK A. PEMBERTON, M.D., BOSTON, MASS.

CANCER of the cervix is being classified histologically according to the predominating type of cell and attempts are being made to find out whether or not these types respond to different methods of treatment.

The two main classes are squamous and adenocarcinoma. The squamous carcinomas may be further subdivided. Schmitz<sup>1</sup> recognizes unripe basal cell and squamous cell types. Martzloff<sup>2</sup> describes fat spindle, transitional, and spinal cell types. The fat spindle cell corresponds to the cells of the deepest layers of squamous epithelium and is long and comparatively broad. The transitional cell corresponds to the cells of the middle part and is round, has a faint cell outline, and a nucleus that stains well. The spinal cell is similar to the cells of the outer layers, it being polyhedral in shape with a well defined cell membrane and a moderately staining nucleus. We understand that the unripe basal cell of Schmitz corresponds to the fat spindle cell of Martzloff, and the squamous of Schmitz includes the transitional and spinal of Martzloff. We have used Martzloff's classification because we believe the three types of squamous carcinoma and the adenocarcinoma can be distinguished and they appear to vary to some extent in their reaction to treatment.

Of 131 cases of carcinoma of the cervix treated at the Free Hospital for Women between Jan. 1, 1917, and Jan. 1, 1924, there are 96 which have full pathologic and follow-up records. These cases were collected and the slides gone over by Dr. R. H. Smithwick, and then the slides were gone over by the reader before knowing Smithwick's results and the two compared. There were a few differences of opinion as to the proportions of the cells in any one case but the predominating type was always agreed on. The method of classification seems reasonable therefore. The tissue contained all three types of cells in most cases.†

The cases were classified by estimating the approximate proportion of the different types of cells in the microscopic section and including that case in the class of the predominating cell type. This is not mathematically accurate but appears to be a working basis. There

\*Read at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 21 and 22, 1926.

†Another paper is to be published by Dr. Smithwick on this series of cases which will cover some of the clinical aspects; the type of case suitable for treatment by operation or by radium; the time to use radium, the dosage of radium; and especially the difference in the treatment of scirrhus and soft tumors.

is some variation in the proportions in slides taken from different parts of the same tumor, but in general a predominating cell type can be determined. In only 15.6 per cent of the cases was a single type of cell found.

The results tabulated with those of other writers are seen in Table I.

TABLE I  
PERCENTAGE OF EACH CELL TYPE IN THE TOTAL NUMBER

	SPINAL	TRANSITIONAL	FAT SPINDLE	ADENO-CARCINOMA
Martzloff 387 cases	15.5	66.8	12	5.4
Pomeroy & Strauss <sup>3</sup> 75 cases	49	28	8	15
Free Hospital for Women 96 cases	30	56	6	8

There is some variation in the different proportions which we cannot account for on any other basis than a personal equation in classifying the type of cell.

Most cases of squamous carcinoma present a combination of the different types but there are some which appear to be pure. Martzloff<sup>2</sup> found 29.6 per cent of his total were pure and we found 15.6 per cent as shown in Table II.

TABLE II

	SPINAL	TRANSITIONAL	FAT SPINDLE	PER CENT OF ALL CASES
Martzloff	3.6	21.4	4.6	29.6
Free Hospital for Women	6.2	9.3	0.0	15.6

Here again there is a considerable difference in results but we can at least conclude that most cancers of the cervix are not of a pure cell type.

We have tabulated our cases by their gross extent according to the classification devised by the Harvard Cancer Commission. Group A cases have the disease confined to the cervix; in Group B cases the disease has spread to the vaginal wall or body of the uterus; in Group C cases the parametrium is invaded; and in Group D cases there is fixation of the organ, or distant metastases, such as those in the iliac glands, are found.

The predominating type of cell in each group was then tabulated giving the results shown in Table III.

TABLE III

	SPINAL	TRANSITIONAL	FAT SPINDLE
A	36	48	16
B	Not enough cases.		
C	31	64	5
D	40	53	7

From this we may conclude that the proportion of the different cell types is about the same despite the extent of the disease. There is a suggestion that the older the growth is the more it inclines towards the transitional and spinal cell type.

In order to get an idea of the relative malignancy of the different types we have classified the cases according to the length of life under treatment because it seemed as if this would give a better idea of the relative malignancy than the time between treatment and recurrence. It is very difficult to decide when a recurrence appears as the case may not be seen often enough and it may be suspected some time before it is definitely proved. We have used averages of the length of life of the cases to draw conclusions from. The cases in each tabu-

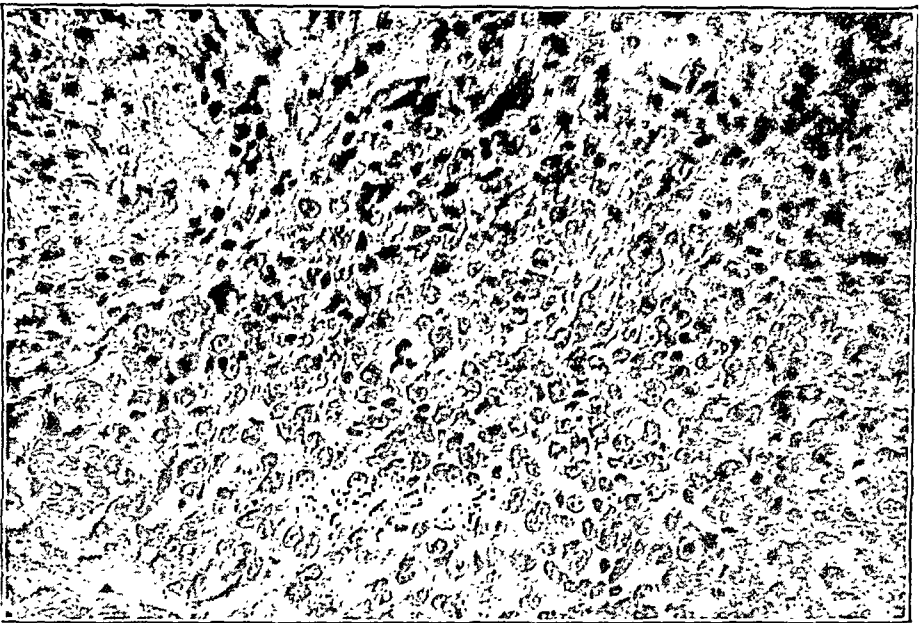


Fig. 1.—Transitional cell type, high power. The nearly circular nuclei and faint cell membranes are characteristic features.

lation are in the same group as regards the clinical extent of the disease and the treatment and, although there are other factors, such as the age and general condition of the patient concerned, it still seemed as if the conclusions would be of value. The cases were treated in different ways so we have had to tabulate them according to the class and treatment.

Nineteen cases including cases of each group, A, B, C, and D, treated by hysterectomy and radium have been omitted in the following tabulation because there was not enough uniformity of treatment to make a comparison with the rest of the cases valuable. Five had radium before operation, four after operation, and ten had radium for recurrences. Two group B cases treated by radium alone have also been omitted, being too few in number.

The five group A cases treated by radium alone which are living show this:

Average for	whole group	52.8 months.
Spinal	2 cases average	55.5 "
Transitional	3 " "	51.0 "

One group A case treated by radium alone was of the transitional type and died at nine months.

The seven group A cases treated by hysterectomy which are living show this:

Average for	whole group	64.4 months.
Spinal	2 cases average	73.5 "
Transitional	3 " "	59.5 "
Fat spindle	1 case	53.0 "
Adenocarcinoma	1 " "	72 "

Of eight group A cases treated by hysterectomy, which have died, three may be considered operative deaths. The other five give this tabulation:

Average for	5 cases	21.2 months.
Spinal	2 " average	63.0 "
Transitional	2 " "	9.5 "
Fat spindle	1 case	23.0 "

There were 38 C cases treated by radium alone all of which are dead, except one which is living and well at 42 months, and was of the spinal type. The average life of those dead was 12.6 months, but when they are divided according to the cell type, we find this:

Spinal	11 cases	average	15 months.
Transitional	22 " "		11.9 "
Fat spindle	1 case		21.0 "
Adenocarcinoma	3 cases		11.0 "

The D cases treated by radium alone number 10 and all are dead at an average of 10.7 months. One lived 57 months, and seven lived 6 or less. According to type they give the following results:

Spinal	5 cases	average	5.8 months.
Transitional	3 " "		21.0 "
(1 lived 57 months, the other 2 averaged 3.5)			
Adenocarcinoma	2 cases	average	7 "

There are six cases three of group C and three of group D, which were treated by hysterectomy alone which give the following:

Average for	whole group	28.5 months.
Spinal 1		12 "
Transitional	5 cases average	31.8 "

In each table except the D cases and the inoperable cases treated by hysterectomy the spinal type show a greater length of life than the transitional. In the D group an exceptional case living 57 months

raises the average of the transitional, but the average of the other two cases is only 3.5 months. In the C and D cases treated by operation there is only one spinal type and conclusions cannot be drawn from it. There are not enough fat spindle type cases to draw any conclusions from.

It may be concluded that the spinal type is the least malignant and is a more favorable type to treat than the transitional regardless of the kind of treatment. The adenocarcinomas came between the spinal and transitional. The predominating type of cell is not an index as to whether radium or operation is the better treatment because the same type in both groups shows the same comparative results.

Martzloff,<sup>2</sup> and Pomeroy and Strauss<sup>3</sup> agree that the spinal cell type is the least malignant, and gives the best results with treatment.



Fig. 2.—Fat spindle cell type, high power. The long and comparatively wide nuclei are characteristic.

Martzloff classified his cases according to their gross extent and the results of operative treatment and found that the spinal type grew the slowest and gave the best results. The order of malignancy of the others was the adenocarcinomas, transitional, and fat spindle, the last being the most malignant. Pomeroy and Strauss found that the spinal and adenocarcinomas gave the best results with radium treatment. Schmitz<sup>4</sup> also believes that the fat spindle type is the most malignant. Schmitz<sup>5</sup> finds that the different types respond to different doses of radium, that is the fat spindle requires the least for a destructive effect, the adenocarcinomas more and the spinal type the largest in the ratio of 100, 150, and 175. Dannreuther<sup>6</sup> believes that the fat spindle cell type is killed the easiest because sections of tissue removed after radium treatment show an absence of this type and

the presence of the spinal type, although both types were present before treatment. Adler<sup>7</sup> and Lahm<sup>7</sup> believe that the fat spindle cell type is the most resistant to treatment. Polak<sup>8</sup> states that the adeno-

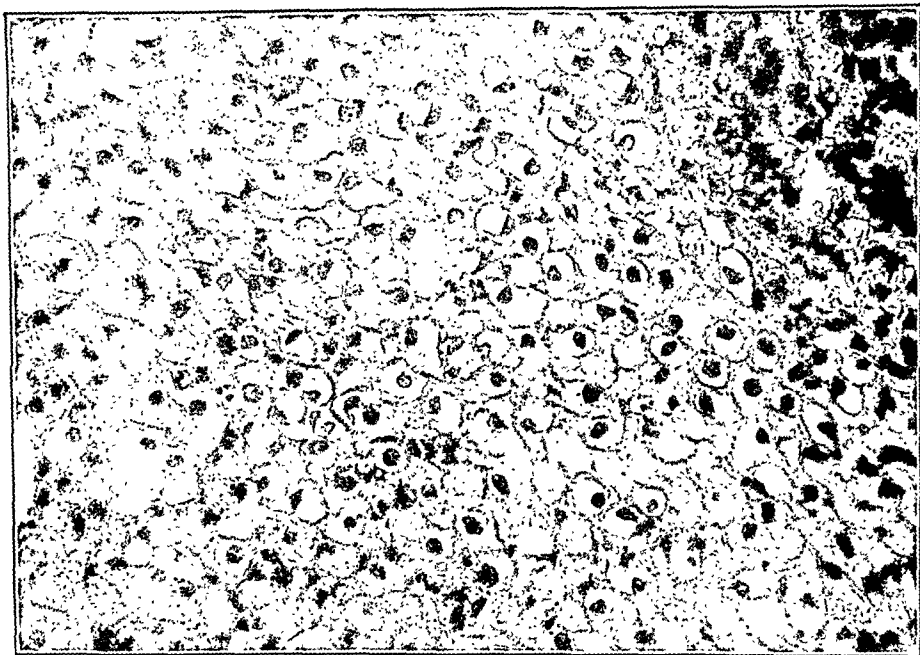


Fig. 3.—Spinal cell type, high power. The distinct cell membranes and polygonal shape are characteristic.



Fig. 4.—Adenocarcinoma, low power.

carcinomas are less susceptible to radium than the squamous. Klemp-  
erer<sup>9</sup> feels that the question of sensitiveness to radium is still un-  
decided. Pomeroy and Strauss<sup>3</sup> find that although the transitional

type is destroyed more easily than the spinal, it appears to recur more rapidly.

We have already shown that most of the squamous carcinomas consist of all three cell types in varying proportion and it would therefore not seem reasonable to vary the dose of radium according to the predominating type. In the pure types this might be tried but if the largest dose is not going to be dangerous to life or health it would seem wiser to give it rather than to go by the histologic type because we are usually depending on a diagnosis from only a small part of the tumor. Dannreuther agrees that the radium treatment should not be varied according to the histologic type.

Klemperer<sup>9</sup> believes that the effect of radiation is determined not only by the tumor type but by its extent and the age and general condition of the patient, and by the amount of the dose of radium.

Schmitz<sup>4</sup> finds that the type of growth whether medullary, simplex, or scirrhus does not seem to influence the radiation sensitiveness of the cancer cells.

We have tabulated our cases according to whether the microscopic section showed the stroma amounting to more or less than 50 per cent of the tissue, giving the following figures:

A. Treated by radium.	
Living	Dead
Stroma more than 50%—3 cases	Stroma less than 50%—1 case
Stroma less than 50%—2 cases	
A. Treated by hysterectomy.	
Living	Dead
Stroma more than 50%—5 cases	Stroma more than 50%—2 cases
Stroma less than 50%—2 cases	Stroma less than 50%—6 cases
C. Treated by radium.	
Living	Dead
Stroma more than 50%—1 case	Stroma more than 50%—5 cases
	Stroma less than 50%—32 cases
D. Treated by radium.	
	Dead
	Stroma more than 50%—3 cases
	Stroma less than 50%—7 cases
C and D cases treated by operation alone.	
	Dead
	Stroma more than 50%—3 cases
	Stroma less than 50%—3 cases

The amount of stroma appears to make some difference in the results because of the preponderance of deaths among the cases with stroma amounting to less than 50 per cent despite the method of treatment.

Theoretically radium should be most effective in the scirrhus types of growth because part of its effect is obtained from the incarceration of tumor cells by dense connective tissue around them.

It seems only fair to say that of the 48 group C and D cases treated by radium alone all but five had a radium dosage of 2400 milligram hours or less at a treatment, and that 30 had two or more treatments. All cases that have had more than one treatment have died. We

believe that cases which have been treated since these with a larger initial dosage, up to 5400 milligram hours, are going to show better results but they are still too recent for any valuable conclusions to be drawn.

#### SUMMARY

The proportion between the three cell types in squamous cancer of the cervix is about the same in the different clinical stages of the disease.

The order of malignancy of the different cell types progressing from least to most is spinal, adenocarcinoma, transitional, and fat spindle.

The type of cell does not indicate whether operation or radium is the better treatment for any type.

The cases having more stroma than cancer tissue respond more favorably to either kind of treatment than where the conditions are reversed.

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(For discussion see page 607.)

## THE CLINICAL SIGNIFICANCE OF X-RAY PELVIMETRY\*

BY HERBERT THOMS, M.D., F.A.C.S., NEW HAVEN, CONN.

(From the Woman's Clinic, Yale University School of Medicine)

**D**URING the past five years, I have been interested in the determination, by means of the x-ray, of the lengths of the diameters of the pelvic inlet. The principles of the method which I have used were first described in a communication which was published in 1922.<sup>1</sup> Since that date, the technic has been simplified and improved, and in the present paper, I shall describe the procedure which is now employed.

The problems of this method of roentgen-ray pelvimetry are two-fold. First, the position which must be maintained by the patient, in order to make the superior strait parallel with the sensitive plate; and secondly, the determination of the degree of divergence from the vertical which the x-rays undergo in their passage from the tube through the superior strait to the sensitive plate. A graphic representation of these problems is shown in Fig. 1, where *T* represents the tube or target, and *PSS* the superior strait, and *SP* the sensitive plate.

\*Read, by invitation, at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 21 and 22, 1926.



It is apparent, on viewing this diagram, that in order that the distortion thus produced may be equal in all directions, the tube must be centered over the superior strait and the plane of the superior strait must be parallel to the sensitive plate beneath.

These conditions are fulfilled when the patient is placed in the semirecumbent position, with the back arched, in the manner shown in Fig. 2. In order to determine the level of the superior strait, it is necessary to identify two points on the external surface of the body. These are located, one on the anterior surface of the symphysis,

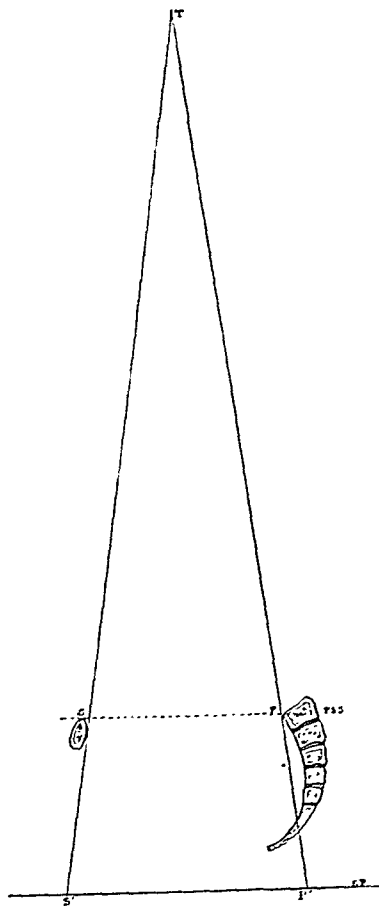


Fig. 1.—Showing direction of rays from target (*T*) through superior strait (*SP*) to sensitive plate. In order to have equal divergence the superior strait must be parallel to the sensitive plate (*S'P'*).

one cm. below the superior border, and posteriorly at the depression just below the spine of the fourth lumbar vertebra. An imaginary line connecting these two points traverses the anteroposterior diameter of the superior strait. It is essential, therefore, that these points shall be of equal distance from the plane upon which the patient sits.

The plane of the superior strait can be made parallel to the sensitive plate by employing the device shown in Fig. 3. With the horizontal arm placed on the upper anterior surface of the symphysis, the height is read from the vertical arm and an equal distance measured pos-

teriorly by means of calipers, as shown. The patient having been placed in this position, the tube is placed 36 inches above the plate, over a point 5 cm. posterior to the upper border of the symphysis

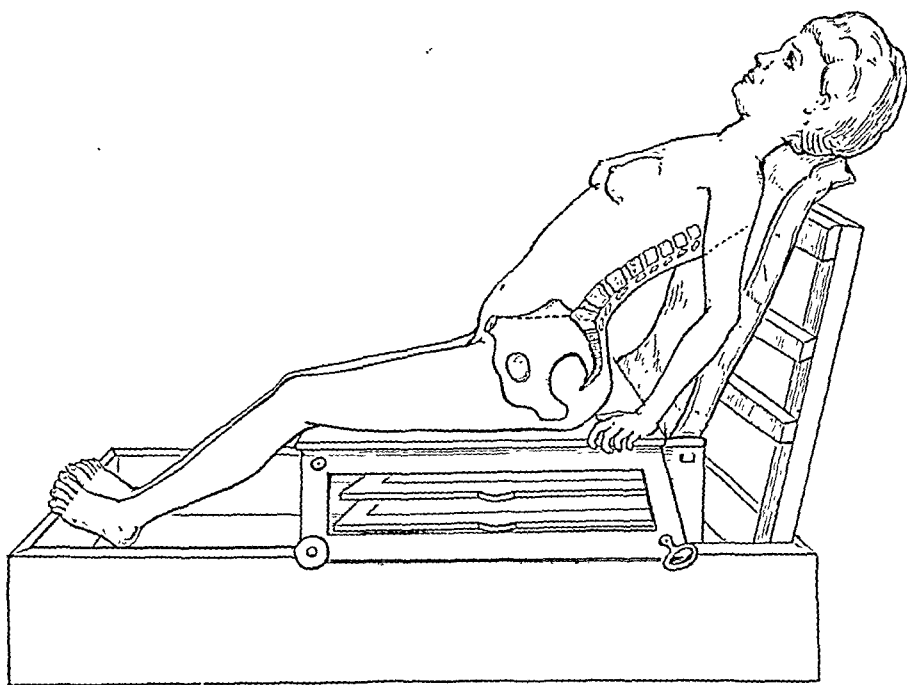


Fig. 2.—Patient in semirecumbent position with back arched. In this position the plane of the pelvic inlet is made horizontal and parallel to the sensitive plate beneath.

pubis. If the tube is centered in this manner, and the pelvis made horizontal, we have found that a moderate variation does not materially affect the end-result. Thus, the tube may vary 2 to 4 cm. away

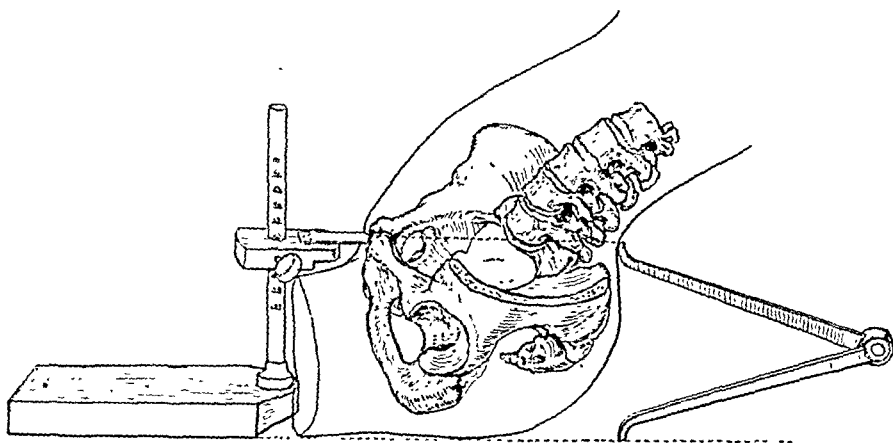


Fig. 3.—Showing method of making superior strait horizontal and parallel to sensitive plate beneath (see text).

from a point above the center of the superior strait, or the pelvis itself may vary 1 or 1.5 cm. from the absolute horizontal, without affecting the reading much more than a millimeter. This leeway makes the method one of practical application, because of personal

variations which are bound to occur, in placing and maintaining the correct position.

The second problem is the determination of the exact amount of divergence or spreading away from the vertical which the rays undergo in their passage from the tube to the plate. The character of the problem will be made clear by the study of Fig. 4. It is evident that in diagram A, in which the superior strait is represented as being 13 cm. above the plate, this divergence will not be as great as in diagram B, in which the superior strait is represented as being 18 cm. above the plate. It is also evident that the degree of distortion for different levels may be readily plotted upon a large piece of paper,

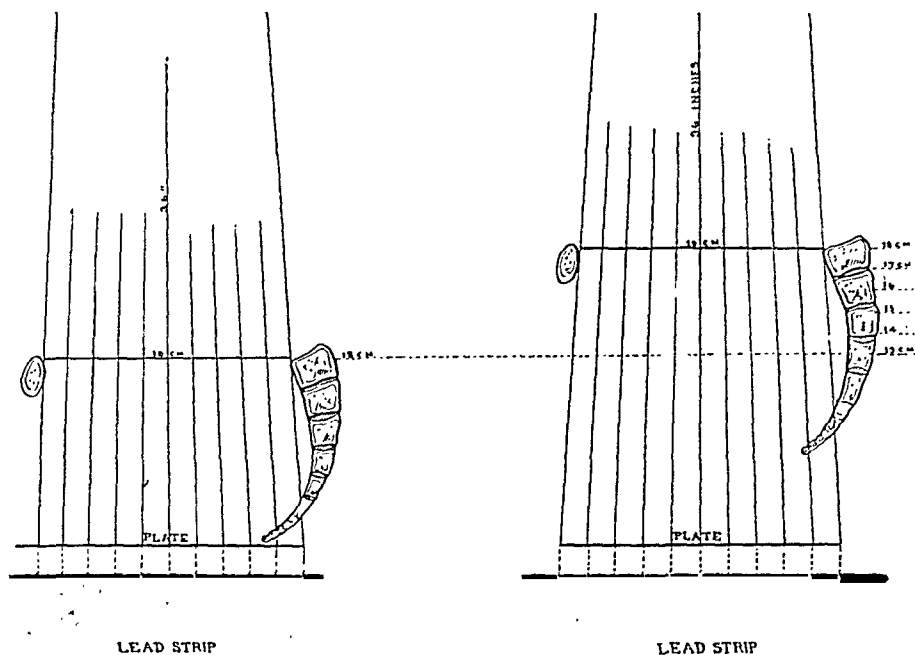


Fig. 4.—Diagrams explaining principle of this method of x-ray pelvimetry. Divergence of rays through the superior strait with the tube at 36" distance is measured and calibrated on lead strips (see text).

with the use of a *T* square and pencil. We determine, therefore, for all time, this divergence for planes from 11 to 22 cm. above the plate. The degree of divergence for each level is indicated by a series of notches upon a flat lead strip, and we then possess 11 lead strips notched as shown for the different levels described. It is apparent that these notches represent "corrected centimeters"—that is, each space between the notches represents a centimeter in the plane to be measured. The lead strip is placed upon the edge of the plate just before exposure. For example, if the patient's superior strait rests 16 cm. above the plate, number 16 strip is used. The amount of ray divergence at 36-inch tube distance is not as great as one might suppose; for instance, at a 19 cm. level, it is approximately as in the ratio of 10:12.5. That is, 10 cm. at the superior strait becomes 12.5 cm. on the plate.

The x-ray technic is as follows: Duplitized superspeed films, a double screen with Bucky diaphragm, and a medium focus Coolidge tube are used. The distance of the target plate is 36 inches. A point spark gap distance of 7 inches—which is equivalent to approximately 65 kilovolts—is employed. The amount of current is 20 milliamperes, and by using an ammeter in filament circuit, this voltage can readily be obtained without passing the current through the tube. A medium focus Coolidge tube will run easily up to approximately twenty seconds at this setting without greatly overheating. There is no apparent reason why with a heavy patient the tube may not be allowed to cool for ten or fifteen seconds, the patient holding the arched position, with possibly a second setting of the Bucky diaphragm. The time of exposure is as follows:

## TIME

Pregnant		Non-pregnant	
Thin -----	16 seconds	Thin -----	10 seconds
Medium -----	20 seconds	Medium -----	14 seconds
Heavy -----	30 seconds	Heavy -----	17 seconds

As compared with other methods of roentgen-ray pelvimetry, the procedure which I have described is of unusual simplicity. Indeed, after a set of lead strips has been prepared, no further mathematical exercise is necessary, and the procedure occupies scarcely more time than does the taking of an ordinary roentgenogram. It is not necessary to emphasize its value in obstetrical practice. While the usual method of internal pelvimetry focuses attention almost entirely upon the measurement of the anteroposterior diameter of the superior strait, it is possible, by employing the procedure in question, to determine not only the length of this diameter, but also to measure the lengths of the transverse and oblique diameters with remarkable accuracy.

The practical value of such additional information is well illustrated in the accompanying pelvigram, in this case, that of a primiparous patient, the external diameters of whose pelvis were as follows: spines 22; crests 24.5; trochanters 29.25; external conjugate 16.75 cm. She was of short stature and weighed 94 pounds. We have repeatedly proved that in many individuals of this type, particularly those with a slight build, the capacity of the pelvis is surprisingly large, despite the fact that the lengths of the external diameters are far below normal. An examination of the pelvigram brings out this discrepancy—for in spite of the shortened external diameters, the anteroposterior diameter of the superior measures 10.75 cm., and the transverse diameter 12.25 cm.

At this point, I wish to refer to the taking of roentgenograms with the patient in the lateral position, an accessory measure which has been of great usefulness during the past year. This procedure, while not specifically employed as a means of pelvimetry, is of value in depicting the relationship of the fetal head to the superior strait, and is of importance in those cases in which an abnormality in the sacrum is suspected. The technic of the method is simple. With the patient

in the lateral position, the tube is centered over the crest of the ilium 36 inches above the plate, at a point midway between the symphysis and the depression underneath the fourth lumbar vertebra, and a suitable exposure made. The anterior and posterior surfaces of the sacrum in their lateral aspect are well shown and an outline of the fetal head, with its relationship to the superior strait, is readily distinguishable. When it is remembered that the unengaged head of the fetus usually rests with the occipitofrontal diameter parallel to the transverse diameter of the inlet, it is apparent that an estimation of the length of the biparietal diameter can also be made (see Fig. 6).

In the use, therefore, of the two methods above described, we feel that we possess substantial additions to our usual pelvimetric pro-



Fig. 5.—Pelvigram showing outline of superior strait. Scale at side of film in "corrected centimeters." By means of calipers any diameter of this plane may be measured readily.

cedures. Their application is much more difficult to describe than to perform. It is unusual for us, in performing both technics, to occupy more than ten minutes with each patient. Their clinical application is obvious. It is our custom to take pictures of the inlet in all patients in whom the external measurements point to pelvic abnormality. Where the influence of rickets is suspected, we have found at times that the only definite means of diagnosis depends upon the roentgenographic study of the sacrum. The routine use of this procedure in abnormal pelves I feel certain is going to point out a greater incidence of rachitic deformities than we have hitherto supposed, particularly in the milder grades. In patients in whom the fetal head fails

to become fixed at the superior strait at term, we can readily determine whether the nonengagement is the result of bony disproportion or is due to some other factor. In a recent patient, in whom the fetal head was floating at term, a lateral picture showed the presenting part high above the superior strait, in spite of the fact that a space 2-3 cm. in width was present between the posterior parietal bone and the promontory of the sacrum. Although measurements of the diameters of the inlet showed the pelvis to be of adequate dimensions for a moderate sized fetus, manual pressure from above failed to force the occiput into the superior strait. It was evident that some other than



Fig. 6.—Lateral roentgenogram at term. Showing relationship of presenting part to superior strait where disproportion was suspected because of nondescent. No disproportion present, sacrum shows normal concavity of anterior surface.

bony disproportion on the part of the mother was present. Because the previous labor had been terminated by cesarean section, it seemed wise, under the circumstances, to effect delivery in a similar fashion. Following the removal of the fetus, the placental site was found low down on the posterior wall of the uterus, and it appears that the undescent of the fetal head in this patient depended upon interference offered by an unusually low implantation of that organ.

#### SUMMARY

1. A method of x-ray pelvimetry has been presented by means of which the dimensions of the superior strait can be measured with re-

markable accuracy. The method is applicable in any stage of pregnancy and does not require elaborate apparatus.

2. A technic has been described which makes it possible to obtain lateral views of the pelvis showing the contour of the sacrum and the relation of the presenting part to the superior strait. Attention is drawn to the value of such information in the diagnosis of the less severe grades of rachitic pelvic deformity.

3. The importance of the two methods as aids in the study of contractions of the pelvis is emphasized.

In conclusion, I wish to acknowledge my indebtedness to Dr. C. R. Scott and Mr. E. F. Furbush, of the Department of Roentgenology of the New Haven Hospital. Their help in working out the technic of taking the pictures has been invaluable.

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(For discussion see page 599.)

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## TRIAL LABOR IN THE TREATMENT OF 477 CASES OF CONTRACTED PELVES\*

CONDUCTED UNDER ONE PLAN OF TREATMENT DURING THE LAST  
FOUR YEARS

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OBSTETRICS is, for the most part, in the hands of the general practitioner, and as perfect surgical technic is not readily acquired by the occasional operator, the existing high maternal death rate is without doubt related to his errors. These have become more pronounced in the last few years, for conservatism has been abandoned and we are in an era of operative obstetrics. This is due to the attitude of the leaders in the medical centers. Because of the high infant mortality, the time honored resources of induction, high forceps, version and craniotomy are frowned upon in the management of labor in contracted pelves. When disproportion is present or the pelvic measurements are below normal, it is impossible to judge whether or not a spontaneous delivery can occur, and if in a test of labor the head fails to engage, the accoucheur has now but one procedure at his command. He must do a cesarean section or send the patient to a hospital where, frequently, a man unversed in obstetrical mechanism opens the uterus forthwith. The incidence of cesarean section has increased until in certain clinics it is as high as 7.1 per cent.<sup>1</sup>

The question to be considered is whether the adoption of cesarean section has resulted in an increased saving of life of mother and child. In New York State (outside of New York City) one out of

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\*Read at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 21 and 22, 1926.

every five maternal deaths follows cesarean section. In the year 1922, 127 women died following this operation. In 79 of the cases, concerning which questionnaires were answered by the doctor, 25, or nearly one-third of the babies were stillborn.<sup>2</sup> In Massachusetts, in the same year, 102 women died following cesarean section; 37 per cent of these operations were for pelvic contraction. The death rate was one in every seven maternal deaths and the fatality for the operation was 8.8 per cent. Of these 102 dead mothers only 67 per cent of the babies survived, and it is quite evident that in this particular group, recourse to high forceps and craniotomy, where necessary, would hardly have produced such a high infant death rate.<sup>3</sup> The results of a questionnaire sent to hospitals in Michigan showed that the maternal death rate (in the 192 answers, 1914-1920) was 10.9 per cent and the infant death rate 13.5 per cent.<sup>4</sup> Nothing could be more startling than the report from New Orleans. In 117 abdominal sections in one hospital there were 12 deaths from peritonitis, 2 from sepsis and 2 other deaths from the operation. In addition there were 25 deaths due to the disease for which the cesarean was performed and the total death rate following cesarean section was 35 per cent.<sup>5</sup> These figures are amazing and show how far the pendulum has swung.

No one would advise the readoption of induction of labor as a general treatment for cases of contracted pelvis yet there are figures that prove it to be much less detrimental to mother and child than cesarean section."

In the latter part of 1921 we became convinced that the Kroenig, Beck, DeLee transperitoneal, low flap cervical cesarean section gave better results, late in labor, than the classical operation. Beck's paper<sup>6</sup> and later, DeLee's,<sup>7</sup> fortified us in this conclusion. Previous to 1922 the published figures did not justify us in conducting trial labors. In 1920, Campbell<sup>8</sup> reported 92 cases operated late in labor with a fatality of 15.5 per cent. We had, also, the report of the English cases in which the mortality, after cesarean section performed late in labor, was 10.7 per cent.<sup>9</sup> The introduction of the low flap cervical cesarean enabled us to conduct trial labor. Hofbauer<sup>10</sup> has recently demonstrated evidences of increased resistance to infection in the lower uterine segment.

*Trial Labor.*—All pelvises with a true conjugate below 7 cm. are absolutely contracted and should be delivered by elective sections. It is interesting to note that during the last four years we had only two cases of absolute contraction. In generally contracted pelvises with breech presentation elective sections were done except in the cases noted below. All patients with relatively contracted pelvises,

\*From 1912 to 1920, at which date the operation was given up at the Manhattan Maternity Hospital in New York, there were 44 inductions for contracted pelvises with no maternal deaths and 10 per cent infant deaths.



with the exception of those who had been previously cesareanized, were given a trial labor. The trial labor was conducted by allowing the patient to have twelve hours of strong pains and without vaginal or rectal examinations. If at the end of this time, the head was floating, a low flap section was performed. If the head was in the pelvis the patient was delivered either by permitting the labor to continue or by forceps. As many of our patients were ambulance cases and nearly one-half of the total number were delivered on our outdoor services, this régime could not be strictly adhered to and we regret that a few patients had a prolonged labor. In some cases where there was doubt as to whether or not the head had entered the pelvis, vaginal examinations were made.

There is some danger in permitting too long a trial labor. If the patient goes into secondary inertia she almost invariably suffers from an acidosis and may even lose her life from this condition.

*Classification.*—We have reduced the generally accepted measurements of pelvic contraction by deducting one-half centimeter from the diagonal conjugate so that our classification includes no pelvic inlet with a diagonal conjugate of more than 11 cm. for the generally contracted and 10.5 cm. for the flat type. These figures have been selected for two reasons. In the first place, all of our patients with higher measurements were delivered spontaneously or with low forceps, and in the second place, the average reach of the examining finger is seldom over 11 cm. Many women have a diagonal conjugate measurement just above 11 cm. and designating such pelvises as contracted magnifies the incidence and importance of the condition. Furthermore, we have deducted 1.5 cm. from the diagonal conjugate to determine the true conjugate because 1.5 cm. is in accordance with the measurements as we have determined them on dry specimens and also because this distance is variable, depending upon the movement of the lower part of the body on the sacrum.

In determining the outlet contractions we have deducted one centimeter from the usual measurements, and we consider a funnel pelvis one with a transverse of 7 cm. or under. We have noted, in private practice, that a large proportion of women have a transverse measurement of 8 cm. and that these patients deliver spontaneously, without prolongation of labor or increase in the lacerations.

The regular reduction in the interspinal, intercrural and oblique measurements in the generally contracted pelvises enabled us to differentiate them from the flat. It is of great importance to distinguish between these types because the mechanism of labor differs. The external conjugate measurement was of little value in estimating either the degree of contraction or the possibility of a spontaneous delivery. We were able, also, to determine the types of pelvises by the changes in form of the Michaelis' rhomboid.

In a certain number of cases the internal measurements were not obtained until late in the postpartum period as we wished to avoid vaginal examinations in order to limit the chances of infection. With this limitation of infection in mind, we have developed our technic of external examination and mensuration to a degree whereby we can usually conduct labor to its outcome without vaginal or rectal examinations.

TABLE I

ESTIMATED TRUE CONJUGATE MEASUREMENTS IN 221 GENERALLY CONTRACTED AND 218 FLAT PELVES OCCURRING IN 9087 DELIVERIES AT BELLEVUE HOSPITAL AND THE BERWIND CLINIC, 1922-1925

ESTIMATED TRUE CONJUGATE	METHOD OF DELIVERY									
	SPONTANEOUS		CESAREANS		FORCEPS		VERSIONS		CRANIOTOMIES	
	G. C.	Flat	G. C.	Flat	G. C.	Flat	G. C.	Flat	G. C.	Flat
6.5	0	0	0	2	0	0	0	0	0	0
7.0	0	1	1	0	0	0	0	0	0	0
7.5	1	4	3	2	0	0	0	0	0	0
8.0	9	9	5	7	0	2	0	0	1	1
8.5	52	73	8	10	8	25	2	5	1	0
9.0	45	57	3	4	8	8	2	2	0	0
9.5	61	0	4	0	4	0	0	0	0	0

Accepting the fact that a pelvis is rachitic when the interspinal and intercrystal measurements are nearly equal and the outlet is wide, there were only 18 cases that gave unmistakable evidence of the disease either through pelvic or general examination. Two cases had the same interspinal and intercrystal measurements and in 16 these measurements were within 1.5 cm. of each other.

We have classified all pelves as generally contracted, flat, funnel or irregularly contracted, and under these classifications there were, in a total of 9087 cases, 221 generally contracted, 218 flat, 35 funnel and 3 irregularly contracted pelves.

#### *Generally Contracted Pelves.*—

Major Contractions: true conjugate 8.5 – 7.5 cm.

Minor Contractions: true conjugate 9.5 – 8.6 cm.

Two hundred and twenty-one or 2.4 per cent of all the deliveries were in women with generally contracted pelves. The average measurement for the crests was 24.4 cm.; in only 5 cases was it as high as 26. Twenty-three per cent of the deliveries were operative.

Ten of the 221 women had had previous sections, and therefore, as a matter of course, an elective cesarean was performed as soon as they were received in the hospital. Another of the patients had an elective cesarean for chronic heart disease.

There was a trial labor in the remaining 210 cases. Sixteen cesarean sections were performed. In one case the wound broke down and in four there were stitch abscesses. Eight of the women, including those with infected wounds, had a temperature for two days or

TABLE II  
AVERAGE PELVIC MEASUREMENTS IN 221 GENERALLY CONTRACTED PELVES

METHOD OF DELIVERY	NUMBER OF CASES	SPINES	CRESTS	EXTERNAL CONJUGATE	RIGHT OBLIQUE	LEFT OBLIQUE	DIAGONAL CONJUGATE	TRUE CONJUGATE
Spontaneous	Major	21.2	24.3	18.0	20.3	20.0	9.7	8.2
	Minor	21.4	24.2	18.5	20.6	20.6	10.7	9.2
Cesareans	Major	21.6	23.7	17.3	19.8	19.9	9.5	8.0
	Minor	21.5	23.7	18.0	20.5	20.1	10.6	9.1
High Forceps	Major	21.0	24.3	17.0	19.7	19.7	10.0	8.5
	Minor	22.0	25.0	17.7	20.0	20.7	10.3	8.8
Mid and Low Forceps	Major	21.5	25.2	17.2	20.5	20.5	9.8	8.3
	Minor	22.5	25.0	17.2	20.2	20.1	10.5	9.0
Versions	Major	21.0	24.0	19.0	21.0	20.0	10.0	8.5
	Minor	21.3	25.0	18.0	20.7	20.5	10.5	9.0
Craniotomy	Major	22.0						
	Minor	0					9.8	8.3

more. Vaginal examinations were made in 7 cases, three of them followed by temperature. There were no maternal deaths in these 16 cases. The average weight of the infants was 3098 grams. The average number of hours of labor was twenty-three, or deducting a long labor at home in two cases, the average was seventeen hours.

High forceps operations were employed in 6 cases in which the head had entered the pelvis during the trial labor. There were no maternal deaths and but one infant death.

There were 13 mid and low forceps deliveries with 3 infant deaths. One mother died of sepsis on the eighteenth day postpartum.

Five versions and breech extractions were performed with the loss of one infant,—a baby that died in utero from premature separation of the placenta. We wish to state definitely that we do not believe in permitting a patient with a breech presentation in a generally contracted pelvis, to have a trial labor, and we do not believe in versions in this type of pelvis, but in the delivery of so many cases, variations from a standard routine are almost unavoidable.

There were 2 craniotomies. One patient was admitted after a long labor with an attempt at forceps delivery at home. A version and extraction was performed, but as the child was dead, the after-coming head was punctured. The other was admitted with a shoulder presentation and a prolapsed arm. As the baby was dead the delivery was by version and craniotomy.

In the 221 cases there were 13 stillbirths and neonatal deaths; six of these followed spontaneous deliveries.

There were three maternal deaths; one woman with a major and two with minor contractions. One woman was delivered spontaneously on our outdoor service, and because of hemorrhage the placenta was manually removed. Sepsis followed and the patient died on the sixteenth day. The second woman was delivered by a mid-forceps operation for an occiput posterior position; the operation was not difficult. She had a form of postpartum sepsis that resembled scarlet fever, and on the eighteenth day, three days after her temperature was normal, she died suddenly of a septic embolus in the brain. The autopsy showed pyelitis of both kidneys, and in the brain there was considerable degeneration around the thrombosed area. The third patient, after thirty hours of labor on our outdoor service was transferred to another hospital. Four hours after her admission she was prepared for cesarean section, and shortly after the anesthesia was started, she suddenly died. The autopsy was negative but as we believe that death might have been due to acidotic shock following a long labor, we have included this case with our maternal deaths. These three were the only deaths that occurred in the 477 cases and one of these women died from a cause unrelated to the pelvic contraction.

TABLE III  
AVERAGE PELVIC MEASUREMENTS IN 218 FLAT PELTS

METHOD OF DELIVERY	NUMBER OF CASES	SPINES	CRESTS	EXTERNAL CONJUGATE	RIGHT OBLIQUE	LEFT OBLIQUE	DIAGONAL CONJUGATE		TRUE CONJUGATE
Spontaneous	Major	14	24.2	27.2	19.5	21.9	9.3	7.8	
	Minor	131	23.9	27.1	19.1	21.5	10.2	8.7	
Cesareans	Major	11	24.6	27.5	18.4	21.8	9.2	7.7	
	Minor	16	23.6	27.2	19.1	21.3	10.0	8.5	
High Forceps	Major	0							
	Minor	11	23.5	26.6	18.8	20.9	10.1	8.6	
Mid and Low Forceps	Major	1	25.0	26.0	18.0	22.0	9.5	8.0	
	Minor	26	23.7	27.1	19.4	21.5	10.2	8.7	
Versions	Major	0							
	Minor	7	23.4	26.9	19.4	19.8	10.1	8.6	
Craniotomy	Major	1	23.0	27.0	21.0	23.0	9.5	8.0	
	Minor	0							

*Flat Pelves.*—

Major Contractions: true conjugate 8–7 cm.

Minor Contractions: true conjugate 9–8.1 cm.

It was an unexpected finding that the flat pelves nearly equalled in number the generally contracted. Furthermore, it so happened that there were 27 cesarean sections.

Ten sections were elective: 7 because of previous cesareans, one because a patient with a major contraction had had stillbirths in three previous deliveries, and 2 for prolapsed cords. There were 2 infant deaths.

In the 208 cases that had a trial labor, 17 cesareans were necessary. The wound broke down in one case and there were stitch abscesses in two. There was a temperature for two days or more in 10 cases, including those with the wound infections. In four cases vaginal examinations were made without any morbidity in the postpartum period. The average number of hours of labor in these 17 cases was twenty-six and eight-tenths, including 5 cases transferred from the outside with an average of forty-three hours. The average weight of the babies was 3337 grams. It is interesting that the average weight of the children in the flat pelves is only 239 grams higher than that of the infants in the generally contracted pelves.

There were 38 forceps deliveries of which 11 were high forceps. Two stillbirths occurred with the high forceps deliveries, one in a case with prolapsed cord. In the 27 mid and low forceps, there was one stillbirth—an infant with hydrocephalus.

Seven versions and breech extractions were performed. One stillbirth occurred in a case of prolapsed cord. One patient who had had a cesarean section at a previous delivery was delivered from below because, when admitted, she had influenza and was fully dilated, with the breech presenting. Two other cases of breech presentation were allowed to have a trial labor and were then delivered by breech extraction.

There was one craniotomy. The patient had been in labor forty-two hours at home, under the care of a private doctor, and as many vaginal examinations had been made, it was felt that a cesarean was inadvisable. The extraction following a version was difficult, and the craniotomy was done on the after-coming head.

In the 218 cases of flat pelves, 73 (or 33 per cent) were operative deliveries. There was a total of 12 infant deaths, 5 of them occurring in spontaneous deliveries.

*Funnel Pelves.*—

Major Contractions: transverse 6–5 cm.

Minor Contractions: transverse 7–6.1 cm.

Eleven of the 35 cases in this group were operative: 3 cesareans, 7 forceps, and one version. There were one stillbirth and one neonatal

death in the spontaneous deliveries and one neonatal death followed the version.

One of the three cesareans was for a major outlet contraction in a pelvis that was also somewhat flattened, and two were for minor contractions in pelvis that were also generally contracted. In the three cases the head was floating after hours of labor. These cases have been included in the funnel class because the narrow transverse was the distinguishing feature of the pelvis. The two generally contracted were of the male type.

TABLE IV  
TRANSVERSE OF THE OUTLET MEASUREMENTS IN 35 FUNNEL PELVES

TRANSVERSE OF THE OUTLET	TOTAL NUMBER OF CASES	METHOD OF DELIVERY				
		SPONTANEOUS	CESAREAN	HIGH FORCEPS	MID FORCEPS	VERSION
5.5	1	0	1	0	0	0
6.0	2	1	0	0	1	0
6.5	5	2	2	0	0	1
7.0	27	21	0	2	4	0
	35	24	3	2	5	1

Seven forceps deliveries were necessary, 6 in pelvis with a transverse of 7 cm. and one high forceps in a pelvis with a transverse of 6 cm. There were no infant deaths.

In addition, 12 contracted outlets of the minor variety were found in pelvis that were generally contracted or flat, and in these cases there were 5 cesareans and 3 forceps deliveries. I believe that in considering the funnel pelvis these 12 cases should be added, thus giving a total of 47 funnel pelvis or approximately 10 per cent of all the cases. Nineteen or 40 per cent of the 47 funnel pelvis required operative delivery. There were no maternal deaths and 6.3 per cent infant deaths.

*Irregular Contractions.*—There were 3 irregularly contracted pelvis. One was a case of infantile paralysis with scoliosis; the second, marked scoliosis of the thoracic and lumbar spine; the third, ankylosis of the hip with flattening of the side wall of the pelvis.

Two of the cases required cesarean sections and the third a mid forceps operation. One baby delivered by cesarean died in the neonatal period.

*Discussion.*—If we accept this report as indicating a satisfactory result with trial labor in contracted pelvis, it seems to me that the ordinary accoucheur would find it advisable to employ this form of treatment in all relatively contracted pelvis. He would have (at least in the region around New York where there is little rachitis) an incidence of less than 6 per cent of contracted pelvis that required treatment as such. While, according to our figures, 30 per cent would prove to be operative, only 16 per cent would demand cesarean or

high forceps operations. The incidence of the cases that must be transferred for major operations would be nine-tenths of one per cent. It seems probable that if the occasional operator knew that the more serious type of case is less than one in a hundred, he would be willing to refer such cases to a suitable hospital where a low flap, cervical cesarean section could be performed.

TABLE V  
477 CASES OF CONTRACTED PELVES IN 9087 DELIVERIES

	TOTAL NUMBER OF CASES	TOTAL SPONTA- NEOUS DELIVERIES	OPERATIVE DELIVERIES					
			TOTAL	CESAREAN	HIGH FORCEPS	MID FORCEPS	VERSION	CRANIOT- OMY
Generally Contracted	221	168	53	27	6	13	5	2
Flat	218	145	73	27	11	27	7	1
Funnel	35	24	11	3	2	5	1	0
Irregular	3	0	3	2	0	1	0	0
	477	337	140	59	19	46	13	3

Net Maternal Death Rate—0.42 per cent.

Net Infant Death Rate—4.19 per cent.

In the spontaneous deliveries, labor was not longer than in the spontaneous deliveries in normal pelves; as a matter of fact, the average hours of labor in both the generally contracted and the flat types was less than normal. The mechanism of labor in the generally contracted pelvis is more perfect than in the normal because there is complete flexion of the child's head. In the flat pelvis the head often hangs up at the brim and passes through in an asynclitic position, and there is an anterior or posterior parietal bone presentation. We have not used the Barton forceps for the control of this, as we believe that it is Nature's attempt to compensate for the disproportion. Occasionally in the anterior parietal bone presentation we have pushed the occiput to the rear at the same time that the external hand pushes over the child's shoulder. At a certain point in the progress of the child's head through the contracted inlet this is readily done and labor comes to a close without more difficulty.

In the 145 spontaneous deliveries in generally contracted pelves, 118 women had a labor of twelve hours or less, and 8 had a labor of more than twenty-four hours. There were 146 cases of spontaneous delivery in flat pelves in which a complete record of the hours of labor was kept. One hundred and ten patients had twelve hours or less of labor, and only 12 had more than twenty-four hours.

Our statistics show that the generally contracted and flat pelves are nearly equal in number and that few of the deformities are due to rickets. Seventy-five per cent of these pelves had a true conjugate of 8.5 or 9 cm.; there were only two with a true conjugate of 7 cm. and two with 6 cm. Seventeen of the cases that we included in the generally contracted classification, were both generally contracted and



flat. As is well known, a decrease in the anterior posterior diameter in a small pelvis markedly increases the necessity for operation and in these 17 cases there were 9 cesareans. The other 8 cases delivered spontaneously with an average of nine hours of labor.

TABLE VI  
AVERAGE PELVIC MEASUREMENTS IN 220 GENERALLY CONTRACTED\*  
AND 218 FLAT Pelves

MEASUREMENTS	220 GENERALLY CONTRACTED		SPONTANEOUS 145	OPERATIVE 73
	SPONTANEOUS 168	OPERATIVE 53		
Spines	21.3	21.5	24.1	24.0
Crests	24.3	24.5	27.1	26.9
Ext. Conjugate	18.3	17.7	19.3	18.8
Right Oblique	20.5	20.3	21.7	21.2
Left Oblique	20.3	20.2	21.7	21.4
Diagonal Conj.	10.2	10.3	9.7	9.8
True Conjugate	8.7	8.8	8.2	8.3

\*Measurements not complete in 1 generally contracted pelvis.

Four prolapsed cords occurred in the course of the trial labor in the 210 flat pelvises. Two babies survived, both delivered by cesarean section. On opening the uterus the cord was tied off from the baby and from the placenta and delivered from below.

The number of abnormal positions in all cases of contraction was not greater than is usual in normal pelvises. There were four face, three shoulder and thirteen breech presentations.

We had a low incidence of funnel pelvises of the male type, that is, of those with little disproportion except at the outlet. Only one patient had a transverse measurement of the outlet of 5.5 cm., and she was delivered by cesarean section.

TABLE VII  
29 STILLBIRTHS AND NEONATAL DEATHS IN 477 CASES OF PELVIC CONTRACTION

METHOD OF DELIVERY	GENERALLY CONT'D		FLAT		FUNNEL		IRREGULAR	
	STILL- BIRTHS	NEO- NATAL DEATHS	STILL- BIRTHS	NEO- NATAL DEATHS	STILL- BIRTHS	NEO- NATAL DEATHS	STILL- BIRTHS	NEO- NATAL DEATHS
Spontaneous	2	4	3	2	1	1	0	0
Cesareans	0	0	1	1	0	0	0	1
High Forceps	1	0	2	0	0	0	0	0
Mid Forceps	2	1	1	0	0	0	0	0
Version	1	0	1	0	0	1	0	0
Craniotomy	2	0	1	0	0	0	0	0
	8	5	9	3	1	2	0	1

Gross Infant Mortality—6.08 per cent.

Net Infant Mortality—4.19 per cent.

#### SUMMARY

The Cornell teaching service, during the years 1922 through 1925, delivered 9087 women on three services—Bellevue Hospital and the Bellevue School for Midwives during six months of each year and the

Berwind Maternity Clinic during twelve months. There were 477 cases of contracted pelves or 5.2 per cent. As far as possible the treatment of the patients was by trial labor, and in my opinion, the success of the procedure depended upon the fact that the low flap cervical section was done in cases in which the head did not engage. There were 59 cesareans with no maternal deaths and 3 infant deaths. In the 22 elective sections, there were 14 low flap operations. Four patients had postoperative temperature. The wound was infected in 3 cases. Vaginal examinations were made in 2 cases but with no morbidity in the postpartum period.

Thirty-seven patients had a section following trial labor and of these 35 were operated by the low flap method. In the group there were 11 cases that had been examined vaginally. The study of the convalescence shows that 21 of the patients had a temperature of 100.4 degrees or higher for two days or more, 4 had a temperature for two days, 12 for less than five days, 1 for six days and 4 for eight days. The wound healed by primary union in 28 cases with postoperative temperature; in 2 cases it broke down, and in 7 cases there were stitch abscesses. Only one of the patients had a serious postpartum condition; in most of the others the fever occurred in the first few days following operation. We feel that the protection of the incision will eliminate some of the infections, as it is probable that these occur when the child and the membranes are brought through the wound. The postoperative period was peculiarly free of the complications that usually follow the classical section.

As an end-result of trial labor, in the 477 cases, there was a gross mortality of three mothers, two dying of sepsis and one from anesthesia in a hospital not under our control. If we except the patient with sepsis following spontaneous delivery, there was a net mortality of two, or one in 238 cases. There was a gross mortality of 29 babies or a net mortality of 20. We had, then a maternal death rate of .42 per cent and an infant death rate of 4.19 per cent.

Trial labor in relatively contracted pelves reduces the incidence of operation and results in a minimum mortality for mother and child provided that when a cesarean is necessary the low flap cervical section is employed.

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- <sup>8</sup>Campbell, A. M.: Jour. Mich. State Med. Soc., December, 1920.
- <sup>9</sup>British Med. Jour., Oct. 21, 1921.
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(For discussion see page 594.)

## LIGATION OF PELVIC VEINS IN THROMBOPHLEBITIS\*

By R. R. HUGGINS, M.D., PITTSBURGH, PA.

IN THE year 1912, the writer reported four cases where ligation of veins had been done in the treatment of puerperal thrombophlebitis. The history of this operation was also reviewed. It is not our purpose to waste time in the study of the past, so far as the history of this procedure is concerned. It does seem worth while, however, to report our results from time to time in order that some definite conclusion may finally be reached as to the value of this method in the treatment of this form of puerperal infection. The pathology is so well understood that it need not be discussed. Little has been written upon this particular line of treatment since that time. The available number of cases for study at the time of this report was 110. Sanes in a report some months later found 12 additional cases which made in all 122. The mortality was 52.5 per cent. It is quite apparent from a study of this small series of cases that operation was not performed in a majority of instances, until the patient was profoundly ill. Turenne in 1917, reported 17 cases, which included 4 operated upon by the writer, with a mortality of 29.4 per cent.

The operative treatment has at least accomplished one thing, and that is a better knowledge of the diagnosis and pathology of this form of infection. The few reports which appear, indicate that the symptoms which are characteristic of this particular form of infection are now generally recognized. This is a distinct advance, for if operative treatment is ever to be employed it is only after most careful study and observation. Mild cases are constantly observed where no thought of operative treatment should be entertained. On the other hand a patient is occasionally encountered where the symptoms are severe, and where in spite of all palliative measures, the disease grows progressively worse and the patient finally dies.

It remains to be decided whether in such a case, operative treatment is worth while. Those who have had the largest experience in the exploration and ligation of the invaded vessels are more inclined to favor it than those who have had little experience. The reason is, because they have learned that an operation undertaken early before the patient has lost much of her resistance, does little if any harm. We have never seen the chances of a recovery lessened as a result of exploration of the abdomen. It is idle to expect good results if the

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operation is postponed until the patient is moribund. For this reason correct diagnosis at the proper time is most necessary.

According to our present knowledge this variety of infection should be recognized from the study of the clinical chart. The wide range of temperature, which may vary from below normal to 104 or 105, in the form of daily excursions; the pulse corresponding to the rise and fall of temperature; the presence of chills, especially during the early stages; a patient who in the first few days of her illness does not present the appearance of one acutely ill; the absence of positive blood cultures under ordinary methods. These are all signs which are most suggestive, and as a rule, are diagnostic of this particular form of infection. When local examination reveals only the presence of moderate enlargement on either side of the uterus and possibly only tenderness, strong corroboration is added. We recognize, of course, the acute fulminating variety where the disease is more virulent and where the patient dies in a very short time. In such cases the progress is so rapid that the patient dies within a few days. In such a condition, operation is useless, for as a rule, there is a rapid spread of the infection through the blood stream which is soon overwhelming. From the beginning the outlook is grave. The case where the operation is of value is one which lies between the above-mentioned milder forms, where the temperature and pulse variations are not so wide, and where the patient from the beginning does not show evidence of very serious involvement, and the acute fulminating variety where the progress is rapid and grave from the beginning. Here we find a group of cases which are prone to become chronic and where in about eight or ten days after the onset of the infection, one is gravely perplexed as to what may happen from day to day. Such a case may eventually entirely recover under palliative treatment; on the other hand, she may drift on from day to day, at times showing marked improvement which leads the obstetrician to be encouraged, but finally dies. It is at this particular time, early in the history of such a case, and before the patient has become repeatedly saturated with the infection, and where a certain amount of poison is being thrown into the circulation daily, with a resulting lowering in her resistance, that a definite conclusion as to the indication for operative treatment should be made. It is fortunate, that in the majority of instances, the progress is rather slow and for the first ten or twelve days the patient may not be in any immediate danger.

Our experience leads us to conclude that there is little difficulty in coming to a determination, both as to a probable diagnosis and to the time when the patient is entitled to an exploration of the abdominal cavity. Our records show that nearly all cases of this class which are operated upon within twelve or fifteen days after the onset of the infection, recovered. The mortality lay in those who had been ill for

more than four weeks. In three fatal cases, more than six weeks had passed before operation was even considered. Infection had already extended far beyond the veins in the form of multiple abscesses or so-called pyemia. Operation at such a time is a useless expenditure of energy, just as it often is in the later stage of a peritonitis which has followed a perforation of an appendix or gastric ulcer. In a general way, if a patient has a chill for three or more successive days, accompanied by the typical rise and fall of temperature and the blood cultures as done by the ordinary method are negative, and where no signs of improvement appear, she is entitled to the help which may be received through surgical measures. It is our belief when operation is done in this stage of the disease, that it does not jeopardize the life of the patient. Even in cases where recovery does not occur, the patient's chances are in no way lessened, as they continue to live long after the time of operation, and eventually die from the continued extension of the infection.

During the earlier years in the history of the operative method of treatment, there was considerable discussion as to the method of procedure. At first it was proposed that the veins be approached from behind and that the operation should be retroperitoneal. This method was followed on account of the danger of spreading the infection, causing peritonitis. There was also uncertainty as to whether it was better to ligate or excise the veins. Again what veins should be ligated? It was argued and rightly so that if ligation of the ovarian vein was done, there was nothing to prevent the spread of the infection downward into the internal iliac vein of the same side. It was also pointed out that the ligation of the deep internal iliac vein in a person acutely ill is a difficult and uncertain operation. This is also true.

No harm can come from ligation of the common iliac on either side if there is doubt as to the presence of infection of the deeper veins of the broad ligament, especially if it extends towards the internal iliac vein. Under such circumstances it may be good prophylactic treatment and may prevent the danger of subsequent extension of the infection.

We desire to report eight additional cases making twelve in all. A careful review of these reports will show that all cases operated upon within a reasonable time after the onset of infection with one exception, recovered. The fatal ones had all been sick for periods from five to eight weeks, and at the time of operation had other complications, such as pneumonia and infections of the urinary tract, and were all in poor condition. If these three hopeless cases were deducted, and in all fairness, this should be done, there would be but one death in nine cases. It is our belief that if operation had been

undertaken in the early stages of the fatal cases, that the results would have been entirely different.

Our studies have led to the following conclusions: That diagnosis is not difficult if a careful study of the patient's condition is made. That even when there may be doubt, an exploratory laparotomy in no way interferes with the progress of the case. If a mistake is made, the patient will continue to live as she would otherwise, and hence, no harm has been done. It is not unusual that a small abscess may be discovered either in the uterus or broad ligament, which if dealt with intelligently may alone justify this exploration. Those who have experience will understand that such a condition may be accompanied by chills and a temperature similar to that found in phlebitis.

In regard to the method of procedure. The veins should be ligated through a transperitoneal incision. They need not be excised. The ligature should be placed distal to the point of infection if possible. It is probably true, however, that if this is impossible, good will be secured by a ligation of the vein somewhat short of the extreme extension of the infection, because when the blood current is interrupted the infection will cease to spread and will remain localized. We have not hesitated to ligate both ovarian veins and in one instance the vena cava. There are few apparent symptoms from such a procedure except for a moderate degree of swelling of the legs, which disappears. This is also true of ligation of both the ovarian veins and the common iliaes. In the future, our procedure will be to ligate the common in preference to the internal iliac, as it is easier and can be done more quickly. The results in so far as untoward symptoms are concerned, are no different.

It is to be hoped that the bacteriologist will come to our assistance in earlier diagnosis in the perfection of a method which will detect this apparently mild form of infection which undoubtedly circulates in the blood stream.

The mortality in the entire series of twelve cases, four of which were reported in 1912, is  $33\frac{1}{3}$  per cent. The mortality under expectant treatment of this same class of cases is certainly not less than 66 per cent. Many men believe it is higher if the milder forms are eliminated. As stated above, if four cases all of which had been seriously ill for a period of more than four weeks were deducted, the apparent results would be even better. All four were really too sick for operation and its possible aid was given only after failure for many days of other methods of treatment. The eight cases which recovered were all operated much earlier, all within a period of 19 days after the onset of symptoms and after the institution of all known methods of palliative treatment without improvement.

While our experience with operation has encouraged us to repeat it from time to time during these years, a much larger number of

cases must be reported in order to come to any definite conclusion as to its real value. It is with this spirit that we desire to add this small number to those already reported. It is our belief that no lives have been sacrificed in this study but that several patients have been saved who would have died under any other form of treatment.

#### CASE REPORTS

CASE 1.—*Ligation of ovarian veins and right iliac vein.* Patient aged eighteen, was admitted with a history of having been delivered at full term. Her convalescence was uneventful with the exception of a slight elevation of temperature until the 13th day when she had a chill followed by a rise in temperature. These symptoms continued for a period of six days, the temperature rising to 105°-106° and falling to 100° or below with a corresponding rise and fall in the pulse.

Bimanual examination showed tenderness on both sides of the uterus, more marked on the right. There was also thickening at the outer margin of the broad ligament on this side. The blood cultures were sterile. There was tenderness along the course of both ovarian veins. The diagnosis of phlebitis of the veins of the broad ligament with extension into the ovarian veins and possibly the right iliac vein was made.

Patient was operated upon 19 days after onset of symptoms and both ovarian veins and the right internal iliac were ligated. The veins were not excised. A protective drain was inserted into the pelvis. Patient was very sick following the operation but eventually made a good recovery. Blood cultures taken throughout the illness were always negative.

CASE 2.—*Diagnosis: Thrombophlebitis of ovarian veins.* Patient aged twenty-one was delivered of a full term child and was without symptoms until four days after delivery. On that day, she had a chill followed by an elevation of temperature. These symptoms recurred daily for four days, when she was admitted to the hospital. A study of the history and clinical chart indicated the presence of phlebitis.

Bimanual examination revealed tenderness on either side of the uterus with some thickening of the broad ligaments more marked on the left side. There was some tenderness extending upward along the course of the ovarian vein. Blood cultures negative.

Patient was operated upon on the fifth day after onset of symptoms. The right ovarian vein was thrombosed. It was ligated as high as possible and a portion of the vein resected for examination. There was extensive involvement of the lymphatics behind the peritoneum on that side. The approach had been made through a median incision which was closed after the ligation of the vessel. An incision 3 inches long parallel to and 1 inch above Poupart's ligament was then made and the peritoneum was pushed forward and a drain inserted to the base of the broad ligament. The character of the symptoms gradually changed after operation, the wide excursions of temperature gradually subsiding and the patient made a good recovery.

CASE 3.—Patient aged thirty-six, admitted to the hospital Feb. 25, 1915; normal delivery. On the fourth day after delivery there was some elevation of temperature. This gradually increased during the following 48 hours and on the sixth day, patient had a severe chill. The temperature rose to 105° following the chill. A second chill 24 hours later followed by a marked rise and fall in temperature. The same symptoms occurred on the eighth day following delivery.

Bimanual examination revealed the presence of marked tenderness on either side of the uterus, a mass on the left side apparently due to thickening within the broad ligament suggesting the presence of phlebitis. There was tenderness ex-

tending upward along the course of the ovarian vein on the left side which was most marked at a point opposite the anterior superior spine. The persistence of the symptoms which were gradually increasing in severity and the absence of a positive blood culture made the diagnosis of phlebitis of the veins of the broad ligament and probably the left ovarian vein quite certain. The patient showed evidence of severe illness and in view of the uncertainty attending palliative measures, an exploratory laparotomy was decided upon. The decision was based largely on the local symptoms and the steady progression from bad to worse in so far as the general condition of the patient was concerned.

Twelve days after the onset of symptoms, laparotomy, with ligation of right and left ovarian veins was done. Inspection revealed the presence of a considerable amount of free fluid in the peritoneal cavity. The veins of the left broad ligament were thrombosed, a similar condition extended upward into the left ovarian vein to a point opposite the anterior superior spine. The vein at this point seemed to be completely blocked and was about 3 cm. in diameter. The same condition existed on the right side but to a lesser degree. The pathologic process seemed to involve the veins along the superior border of the broad ligament merging into the ovarian vein and there seemed to be no involvement of the veins in the lower portion of the broad ligament or the internal iliac veins. Both ovarian veins were ligated and a cigarette drain was carried into the culdesac and the abdomen closed.

Patient had no more chills following the operation and the temperature gradually fell to normal within 10 days. She was discharged in one month from the date of operation in good condition.

CASE 4.—*Excision of left ovarian vein, ligation of right ovarian vein.* After an abortion of five months, patient age twenty-two, developed the characteristic signs of phlebitis, recurring chills and elevation of temperature, rising and falling in a typical manner. Her illness had extended over a period of 28 days.

On September 30, 1913, the left ovarian vein was excised after ligation, the right ovarian vein was ligated at its juncture with the vena cava. The patient improved after the operation and the record shows but one chill.

On October 8, 1913, patient developed pneumonia and died October 25, 1913.

CASE 5.—*Puerperal thrombophlebitis. Ligation of the right ovarian vessels, ligation and excision of left ovarian vein and broad ligament, left salpingo-oophorectomy, ligation of vena cava.*

This patient gave a history of having had a miscarriage one month previous to admission. For the past three weeks she had been running a temperature ranging between 104 and chills on an average of about two every 24 hours, temperature and pulse rising after the chill and then receding always with a corresponding improvement in the general appearance, pulse rate, etc. The general appearance of the patient was typical of the third week of a serious infection. The symptoms apparently were progressive gradually increasing in severity and no evidence could be found of any tendency to improvement.

Examination revealed the presence of marked tenderness along the course of both ovarian veins and there was definite palpable thickening on the left side of the uterus. There was no fluctuation and no sign of a localized abscess. The uterus was movable and somewhat larger than normal. The study of the pulse and temperature, the general appearance of the patient and the local signs were diagnostic of phlebitis of the pelvic and ovarian veins. In view of the hopeless outlook, exploratory laparotomy with the hope of ligating the vessels beyond the point of infection was decided upon.

Under spinal anesthesia, the abdomen was opened through low midline incision and free fluid found in the pelvic cavity. The sigmoid was adherent to the left broad ligament. Tube and ovary were adherent posteriorly. Palpation of left broad



ligament showed thickening. The left ovarian vein was isolated well above pelvic brim and ligated. Vein here was not thrombosed. It was divided and dissected down to broad ligament. Broad ligament then clamped below tube and ovary and mass excised. Vessels ligated and peritoneal layers partly closed, and one cigarette drain placed to left kidney fossa and one behind the left broad ligament. The right broad ligament felt normal. Ovarian vessels isolated and ligated en masse over right pelvic brim and small section excised for examination. The vena cava was isolated above the promontory of sacrum to the right of the bifurcation of the aorta. It was as thick as a finger and firm. It had a grayish color and an enlarged gland was lying on its surface. It was isolated and ligated with No. 2 catgut in the thrombosed portion.

One cigarette drain was placed to this and brought out through the lower end of the incision. Incision closed. The right adnexa was inflamed and fibrin was present on surface of ovary.

The vena cava was ligated because of the great difficulty in dissecting out both internal iliac veins and with the possible danger even though this could be done satisfactorily that the infection might still spread through some of the smaller vessels. The patient withstood the shock of operation fairly well and was certainly no worse for having undergone the procedure. There were no chills after the operation and the temperature gradually fell in spite of the presence of a septic pneumonia. The patient lived for 20 days and in the end died of pneumonia which had been present at the time of operation. There was pain and swelling of the left leg with marked tenderness along the course of the veins. This was apparently an ordinary phlebitis and not secondary to the ligation of the veins above. There was some edema of the right limb below but it was not excessive. There seemed to be very little perceptible effect in so far as the ligation of the vena cava was concerned, as the collateral circulation seemed to be quite sufficient. There was very little doubt that, had the same operation been done ten days earlier, the outcome would have been different.

CASE 6.—*Thrombophlebitis of ovarian veins. Laparotomy, ligation of left ovarian vein.* Patient aged twenty-six, delivered at fifth month. Was admitted to the hospital five days later with a history of elevation of temperature and general symptoms of infection. Since admission, the temperature has been running a typical course, characteristic of a localized infection. There have been one or two chills every 24 hours, followed by a marked rise to 103-104°, and then falling to 100° or thereabouts. The symptoms are very typical of phlebitis. The patient has complained of pains in the left lower quadrant of the abdomen and physical examination reveals the presence of a mass in the broad ligament on that side. It gives the impression of a thickened condition secondary to a lymphangitis or phlebitis of the veins in the broad ligament. The right side is free from enlargement. The uterus is larger than it should be at this time. There is no evidence of any infection in the femoral or saphenous veins. The blood cultures have been sterile.

There is little doubt that the symptoms are due to a localized infection either extending through the lymphatics or the veins of the broad ligament. The absence of a considerable amount of pelvic exudate and the severity of the chills and the persistence of serious symptoms justify the diagnosis of phlebitis with its typical train of symptoms. The general condition is very poor, the blood pressure being low, the systolic scarcely 90 and the diastolic about 50. The systolic at the wrist with the finger only shows a pressure of 68. This indicates the gravity of any surgical procedure and yet one feels justified in breaking off this infection if possible, and the procedure contemplated is to be a ligation of the ovarian veins together with the vena cava above its bifurcation.

Operation: Anesthesia: Ether, and local. Midline incision. Exploration revealed the presence of a mass on the left side of the uterus extending from the

middle of the broad ligament to the brim of the pelvis, which consisted of a thickening of the tissues and some enlargement of the Fallopian tube. The ovary was about four times the normal size. From the outer margin of the broad ligament extending upward behind the peritoneum, an enlargement about 2 cm. in diameter was distinctly palpable. It extended upward gradually diminishing in diameter to the renal vein. The entire mass from the broad ligament upwards was very firm in its consistency and of a blue color. The ureter was closely adherent throughout. The condition was that of a typical phlebitis, which involved the veins in the outer portion of the broad ligament extending into the ovarian vein above. Two double catgut ligatures were placed high as near the renal vein as possible. No palpable enlargement could be detected in the veins behind the uterus, namely, the internal iliacs or the right ovarian. There was very little free fluid in the pelvic cavity.

Within three days after operation, the patient's temperature fell to normal. There were no more chills and while the convalescence was slow, owing to some delay in the healing of the wound, the patient made a good recovery.

**CASE 7.**—*Thrombophlebitis of the right ovarian vein. Lymphangitis of right broad ligament.* Admitted to the hospital complaining of chills, fever and lower abdominal pain. Symptoms caused by an induced abortion. During succeeding 17 days, patient had recurring chills followed by elevation of temperature. Examination revealed a tender mass on the right side of the uterus. The temperature and other symptoms were typical of an infection within the veins. This, however, seemed to be complicated by the presence of a possible infection within the cellular tissues of the broad ligament. Operation was done 18 days after the onset of symptoms by my associate, Dr. Cashman.

**Local and ethylene anesthesia:** The right ovarian vein was found thrombosed and with a surrounding lymphangitis formed a firm cord the size of the index finger extending to the vena cava. Exploration of the mass above referred to revealed the presence of an abscess secondary to the lymphangitis within the broad ligament. This was incised and about two ounces of pus evacuated. Double ligatures were placed about the ovarian vein at the highest possible point. On account of the presence of pus, one cigarette drain was placed in the culdesac and one to the abscess cavity.

The convalescence in this patient was complicated by a severe pyelitis which caused some elevation of temperature, otherwise patient made an uninterrupted recovery. The symptoms which were present previous to operation disappeared at once. Blood culture previous to operation showed *Bacillus coli* infection. The same infection was found present from pus in the abscess at operation.

**CASE 8.**—Primipara, aged eighteen, normal delivery. Within 48 hours the patient had a chill followed by a sharp elevation of temperature. It was succeeded by a remission to normal. During the next four days her clinical condition was characterized by daily chills with sharp elevations of temperature to 105° to 106°, succeeded by marked remissions and profuse sweating. During the following week the temperature showed a tendency to subside, with occasional elevations. On the nineteenth day postpartum, the patient developed an acute tenderness in the left inguinal region, with tenderness along the course of the saphenous vein and edema of the leg below the knee. Her temperature rose to 103° with corresponding increase in pulse rate. From the 19th to 29th day postpartum, the temperature fluctuated between 98° and 105°. From the 30th to the 79th day postpartum, the clinical course has been characterized by severe rigors followed by elevation of temperature ranging from 105° to 108° with corresponding increase in pulse rate and succeeded by remissions with profuse sweats. Not infrequently, these chills lasted from one to one and one-half hours. On the 30th day, patient began to

complain of pain in the right renal region. Urine showed albumin, many pus cells and granular casts. Patient was seen by the writer December 30th, forty days after the onset of infection.

Examination revealed tenderness along the course of both broad ligaments with slight induration, more marked on the left side. Blood count showed at this time, Hb. 26 per cent, R.B.C. 1,670,000, W.B.C. 30,000, P.M.N. 91 per cent. Diagnosis: Phlebitis of veins in broad ligament with probable extension into the internal iliacs. Pyelonephritis. Patient seemed hopelessly ill and operation not advised. She was seen again January 9th and while the symptoms had in no way abated, there seemed to be some temporary improvement in the general condition of the patient. In view of the absence of any response to any form of treatment including the use of blood transfusions, antistreptococic serum, etc., it was decided that in spite of her poor physical condition, that some benefit might be derived from an operation. On January 9, under ethylene and local anesthesia, a laparotomy was performed. The right ovarian vein showed definite thickening and the presence of infection. The left was normal. The deep internal iliac veins were thickened, indurated and corrugated to the touch. In view of the serious condition of the patient no attempt was made to ligate the internal iliacs. Both ovarian veins were ligated. In order to save time and yet include the infected area, it was decided to ligate the vena cava. This was presumably done, but it was found later at autopsy, that instead of the vena cava, the left common iliac vein had been ligated. This happened for two reasons: First, the junction of the common iliacs was very high and the left ran in the normal position of the lower portion of the vena cava. At this stage of the operation, the patient came out of her anesthetic compelling undue haste, and in this way our landmarks were lost. This mistake was discovered at autopsy. It demonstrated, however, that ligation of both the ovarian veins and common iliac are not followed by serious symptoms. The left limb was swollen moderately for a few days only. Examination of the right kidney at the time of operation showed it to be about twice the normal size. There were no chills for three days after operation, when they again recurred. The urine at this time was loaded with pus cells, and pain and tenderness in the right kidney increased. Catheterization of the ureters revealed many pus cells and red blood cells from the right kidney. The patient's symptoms persisted and in view of the definite evidence of infection in the right kidney, and the apparent ability of the patient to continue to withstand the infection, it was finally decided to remove the right kidney. This was done January 23rd, fourteen days after the first operation. Following the nephrectomy, the patient had four chills in as many days, the last chill occurring on January 27th. The temperature, save for three elevations to 100° was normal. Patient developed numerous superficial abscesses. A diagnosis of endocarditis had been made previous to her first operation, and symptoms of this complication still persisted. Patient began to lose ground the week following nephrectomy and died suddenly thirteen days after operation.

Autopsy showed acute bronchopneumonia, multiple abscesses of both lungs, multiple abscesses of spleen, acute tubular and glomerular nephritis.

Our only reason for reporting this case is to show that in spite of the grave illness which had lasted over a period of weeks, with recurring chills and high temperatures, we were able to perform two major operations, without in any way lessening her chances for recovery. The complications of infection of the kidneys, myocarditis and multiple abscesses, necessarily precluded her chances of recovery. It was a case in which the infection was wide-spread and not amenable to surgical measures.

*(For discussion see page 612.)*

# PRESENT STATUS OF THE INDUCTION OF LABOR BY MEANS OF PITUITARY EXTRACT\*

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THE object of the investigation which forms the basis of this paper was a desire to know how many obstetricians were using pituitary extract to induce labor, either with or without other drugs, and their opinions of the value of such a method. The indications for the induction of labor vary so greatly that we were not concerned with the discussion of that phase of the subject, but inquired only about the method of induction. Of course it is obvious that if one feels that there is at hand a safe method of starting labor, and especially one not requiring mechanical interference, one will like to feel justified in inducing it in many cases where there would be a hesitancy to use a method that was either dangerous or technically difficult. I also wish to incorporate in this paper a report of our results since the last paper by Dr. P. B. Watson.

Previous to Dr. Watson's<sup>4</sup> first publication in 1913 there were a few accounts in the literature of similar attempts, the earliest of which was by Fries<sup>1</sup> in 1911. Studeney<sup>2</sup> in the same year recorded two attempts and Stein and Dover<sup>3</sup> in 1917 recorded 34 cases of induction at term by means of castor oil and quinine. The first publication by Watson<sup>5</sup> was in 1920, in which he was successful in 53 out of 62 cases. Mendenhall<sup>7</sup> in 1921 reported some satisfactory results at term, but usually combined with other procedures. Mahnert<sup>8</sup> in the same year used it once for induction in a case of albuminuria with twins. Cron<sup>9</sup> in 1922 reported 45 cases ranging from the eighth month to three weeks past the expected date. He combined it with castor oil and quinine and was successful in 65 per cent. Dr. Watson's<sup>3</sup> third paper in 1922 reported 276 cases in which 90 per cent of the attempts were successful, with no maternal deaths and a fetal mortality just over 6 per cent. In a discussion of this paper Culbertson stated that he succeeded in inducing labor in a large proportion of cases with oil and quinine alone, but had also used pituitary without mishap. Johnson<sup>10</sup> in the same year stated that she was using the method, but had reduced the dose of pituitary and had yet to see any evil results. Cleveland<sup>11</sup> on the other hand was of the opinion that only rarely, and in very large doses would it bring on labor at term. Haskell and Rucker<sup>12</sup> from an experimental study arrived at the conclusion that pituitary is more dangerous in the early stages of labor than ergot, as it is more

\*Read at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 1926.

prone to produce either a tetanus or an increase in tone than the latter drug. Steinberg<sup>3</sup> did not succeed in inducing labor with pituitary during an investigation of its action, but thinks that the contractions induced by this drug when used to initiate labor simulate normal contraction more than those which are induced during labor. Brown<sup>14</sup> gave a very comprehensive report of the results in Edinburgh, where it has been the routine since 1921. He was successful in 40 out of 44 cases and all the failures were in premature cases. He "has been able to find no case in the literature in which rupture occurred as a result of pituitary induction." There were 4 stillbirths in the early part of his series, but none in the last 30. J. Whitridge Williams<sup>15</sup> in 1924 followed the Watson technic and was successful in about 75 per cent of cases near term. He did not think its value was great in cases of toxemia because it was useless before the last two months. In a personal communication he states that these views remain the same. Blair Bell<sup>17</sup> in a recent article says he uses it for induction if the child is dead or to obviate the possibility of disproportion between the child and the pelvis. He feels it is contraindicated in uncompensated heart disease. Pouliot<sup>18</sup> in reporting a symposium on the use of pituitary leads one to feel that it is not used in France for the induction of labor but is apparently widely used once labor is established. Parache<sup>19</sup> is opposed to the Watson technic as using too much pituitary. He ruptures the membranes and after waiting from two to four hours gives 1 c.c. of pituitary. If not successful he waits some hours and then gives another dose.

In the attempt to obtain a more comprehensive idea of the value of this method than could be obtained from the literature, a questionnaire was sent to representative obstetricians. One hundred and twenty-one replies were received, all of which were from obstetricians who are Fellows of the American College of Surgeons or of the American Gynecological Society. Seventy-eight of these men are not now using the method, some of them having never attempted it and others abandoning it after a longer or shorter trial.

Of the seventy-eight who do not use the method twelve gave no reason except the fact that they had seen or had heard of accidents when pituitary had been given *during* labor. Throughout the investigation difficulty was encountered due to confusion between the use of the drug once labor was established and its use for induction. One man in this group had seen "bad results when pituitary was used in two cardiac cases," but he did not state whether it was given for induction or not. Another states that he thinks it should be classed as a criminal offense to use it to either induce or hasten labor. Fourteen felt it had no place in obstetrics when we have mechanical means which are so positive and two of these men also felt that pituitary was liable to cause the retention of pieces of placenta. H. M. Little

of Montreal uses oil and quinine before inserting a bag and F. S. Newell of Boston says that most of their inductions are for toxemia before term and a bag is then more reliable. Seven do not use the method because others have found it unsuccessful. Sixteen have tried it and have either failed to induce labor or have had such a small percentage of success that they have gone back to mechanical means. One of these men thinks "it never initiates labor." W. E. Welz, of Detroit, tried 100 cases at term some years ago with no success and had little better results with the Watson method, while F. A. Dorman of New York is of the opinion that it sometimes causes a partially dilated cervix to close. A. W. Bingham of East Orange uses it when the membranes have been ruptured and W. F. Grosvenor of Chicago uses pituitary after inserting a bag. Seventeen replied that they did not use the method but gave no reasons. Eight stated that they were afraid of tetanic uterine contractions. Some of these men have seen such contractions and others have heard of them. W. A. Fowler of Oklahoma City formerly used it at term in small doses after oil and quinine, but has discontinued it because "of an increase in the tonicity of the uterus between pains" and states that he was partially influenced in this opinion by the work of Haskell and Rucker. Irving W. Potter of Buffalo is opposed to induction by any means and J. C. Litzenberger of Minneapolis is awaiting further evidence before trying the method. Two induce only for toxemia and think that the method is then contraindicated.

Forty-three obstetricians are using the method but with varying technics although the majority are using only slight modifications of Dr. Watson's method. Paul Titus of Pittsburgh depended upon oil and quinine until a year ago when he began the Watson method, which he has used in 25 consecutive cases, and R. H. Luikart of Omaha has had slightly over this number. He as well as F. J. Taussig of St. Louis is opposed to the Watson technic but uses small doses of pituitary starting with two minims and increasing slowly according to the reaction. He often loosens the lower pole of the membranes and has the uterus massaged at five-minute intervals. W. C. Danforth of Evanston, Ill., has used it since Dr. Watson's first paper, but with three minim doses and he also loosens the membranes with the finger. C. B. Reed of Chicago has used it at term in 93 cases with two failures and has discovered no dangers. He puts the method below the bag in uncertainty and above it in ease and simplicity of management. A. B. Spalding of San Francisco has had about one hundred and fifty inductions with this method while F. L. Adair of Minneapolis has used the method for years and his opinion remains much the same as in his original article<sup>16</sup> except that he no longer hesitates to use it in toxic cases with hypertension. Palmer Findlay states that he has used it many times and C. Jeff Miller has used it freely since Dr. Watson's

first paper, but has decreased the dose to five minims. He has found that it succeeds more frequently if the patient be kept in bed. B. C. Hirst of Philadelphia has used oil, quinine and pituitary for years, with success in the majority of cases.

The bad results that follow the use of this method are very largely the results of tetanic contractions of the uterus. Smith and McClosky<sup>20</sup> have shown that some of the preparations on the market are as much as eight times as strong as others. With the new international method of standardization of the drug it is likely that this disadvantage will be overcome, but there will still remain the undoubted fact that patients vary in their reaction to the drug. J. Whitridge Williams believes that the fetus is occasionally endangered by these severe contractions, and consequently they now use it only when there are strict indications for induction. Brown<sup>14</sup> had two cases of such contractions, one of which followed packing of the vagina three days after the last dose of pituitary and the child was lost; the other case was induced at thirty-five weeks for a contracted pelvis, chloroform controlled the spasm and a live child was born. Taussig of St. Louis and L. A. Wilson of Charleston each had a case of a multipara with a very rapid labor after its use. R. H. Luikart of Omaha had one tetanic contraction with a dead baby in a series of twenty-five cases. A second one had a precipitate labor and a torn cervix when a nurse gave a further dose after labor was established. A. W. Bingham and J. O. Polak each had one case of detached placenta, the former in a patient to whom he had given pituitary two days before and the latter following a tetanic contraction produced by 5 c.c. of pituitary in small doses. Theodore Miller of Cleveland saw a case in consultation where induction was attempted at eight months. Two doses of 1 c.c. each were given and were followed by a tetanic contraction. He prescribed  $\frac{1}{4}$  gr. morphia and spontaneous labor came on two weeks later with a dead baby. F. C. Irving of Boston saw one case of violent contractions and a stillborn baby, while L. E. Leavenworth of Canton had two cases but both babies were born alive and normal. P. W. Toombs of Memphis saw one case with evident disproportion where consent to a section could not be obtained. Labor was induced with pituitary and tetanic contractions resulted. The heart tones ceased and the patient was delivered by craniotomy. Titus in twenty-five consecutive cases had one of fetal distress and this was delivered by forceps and a second with a precipitate labor and a left lateral tear of the cervix. This patient was given a further dose after labor had started. As regards danger to the mother two cases of rupture of the uterus were encountered. Fordyce<sup>21</sup> reported the first one, his patient being a para xi at term. Her previous children were all large and she had had six difficult deliveries with one craniotomy. She was given three doses of 0.5 c.c. each at one half hour intervals and one

half hour later ordinary pains began and the membranes ruptured. There were two pains in the next quarter of an hour, the second being long and severe. There were no further pains and fifteen minutes later she showed signs of distress. The cervix was found to be nearly dilated with a tear running up into the posterolateral wall. A large baby and placenta were removed from the peritoneal cavity by laparotomy. Fordyce points out that several cases of rupture in the first stage had been reported where no pituitary had been used.

The second case is an unpublished one, the details of which were given me in reply to the questionnaire by Ross Mitchell of Winnipeg. Neither the obstetrician nor the senior intern was present. Labor was induced with castor oil and quinine and pituitary. There was a malpresentation with the left hand and arm flexed around the neck and the hand alongside the chin. The patient died as the result of a partial rupture of the lower segment from the extension of an old cervical laceration.

I now wish to give a brief report of our results since Dr. Watson's last paper. We have tried this method 198 times since the last report, 82 of these cases being from my private practice. Ninety-four of my private cases were included in the previous report making one hundred and seventy-six times that I have attempted this method in private practice. In one hundred and ninety-eight cases we failed to induce seventeen times and of these failures seven were induced subsequently by bag and one was delivered by section after three attempts at induction. This latter case was being induced on account of a small pelvis and the section was done at term. Fifty-nine of these patients were primiparae and one hundred and thirty-nine multiparae.

Of the 181 cases where we succeeded in inducing labor we had 151 normal deliveries, twenty-three forceps, eight breech cases and two craniotomies, one for a hydrocephalus and one for a brow presentation after seventy-two hours in labor. There were three cases of twins. Seven cases were induced by means of oil and quinine alone and in eight cases labor was induced by means of pituitary without previous oil and quinine.

In this series, including the unsuccessful cases, there were eighteen dead babies. Of these, three were induced because of a diagnosis of a dead fetus and two were craniotomies as noted above. Of the remaining thirteen:

One was a case where an unsuccessful attempt was made two weeks before term. Labor began spontaneously at term. The patient had a contracted pelvis, a version was done and the child killed in delivery.

One was a prolapsed cord in a primipara with a breech presentation. The child was alive at the beginning of delivery.

Three were cases of placenta previa, two of which had severe bleeding.



Two were in cases of twins, the first baby in each case being born alive.

Three were induced for toxemia of pregnancy, two of the patients having had convulsions.

One followed a first stage of sixty hours, when the patient was three weeks past the expected date. The next labor was induced at term with a live baby.

Two followed apparently normal labors.

There were two cases of sharp bleeding; one before the birth of the placenta, controlled by manual removal and one after the birth of the placenta, controlled by a further dose of pituitary.

In two instances the placenta was retained, one coming away spontaneously in two hours and the other being removed manually.

Three cases had tetanic contractions of the uterus, all of which were controlled by an anesthetic and all of these babies were alive.

One patient developed an abscess in the hip at the site of injection.

There was one maternal death. This was a primipara sent in from the country with the vagina packed on account of bleeding from a placenta previa. Labor was induced with oil, quinine and one dose of pituitary. Following a forceps delivery of a living child there was a profuse hemorrhage and the patient died in thirty minutes.

#### CONCLUSIONS

1. There is no method of inducing labor that is absolutely free from danger to either mother or child.

2. The induction of labor by the use of pituitary after castor oil and quinine is practically free from maternal danger if properly used.

3. This method has some dangers for the child even with the best of technic and this danger is considerably increased by improper use of the method. This danger consists for the most part of the evil results of the occasional tetanic contractions which result, but such contractions can usually be controlled by the administration of an anesthetic.

4. There is almost unanimous opinion among those using this method that the original dosage as proposed by Dr. Watson is too large and they either use smaller doses throughout or start with smaller doses and increase slowly.

5. The method is being used much more extensively than one would gather from the literature, and those who have used it in a considerable number of cases are, for the most part, continuing to employ and have confidence in it.

6. There is considerable confusion in the minds of many between the use of pituitary to induce labor, as opposed to its use during labor.

7. It cannot be emphasized too strongly that when pituitary is used

to induce labor, it should not be repeated once pains are established. To give the drug under such circumstances is the same as giving it early in the first stage of labor and there is no question about such a procedure being fraught with great danger.

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(For discussion see page 610.)

## LIVER FUNCTION TESTS IN THE TOXEMIAS OF PREGNANCY\*

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MANY tests have been devised for the study of the various functions of the liver, but of the many articles in the literature dealing with this subject during the past few years, only a few treat specifically of the application of these tests to the study of the toxemias of pregnancy. It will be well, therefore, to consider the work which has been done by others along this line before passing to a consideration of my results in a series of tests performed upon 24 patients suffering from these disorders of pregnancy.

One of the first investigators to employ functional liver tests in these toxemias was Walthard,<sup>1</sup> who published the results of his investigations in 1922. After careful and elaborate studies of the blood sugar, the storage capacity of the liver for glucose administered by vein or by mouth, the bilirubin content of the urine, and the rest nitrogen of the blood, he concludes that there is a hyperglycemia and an impairment of the storage ability of the liver in normal pregnant

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women during labor, and that there is also an increase in the urobilin content of the urine. These findings, he believes, cannot be explained on the basis of excessive muscular effort during parturition, as severe exertion on the part of normal pregnant women did not produce similar results. Analogous findings, however, have been noted in diabetic women after severe exertion, and from this Walthard concludes that there is normally some impairment of liver function during labor (the so-called *Geburtsleber*), which tends to clear up rapidly during the puerperium. In eclampsia Walthard found marked disturbance of liver function, as evidenced by a considerable elevation of the blood sugar, a marked depression of the storage capacity for glucose, and an increase of the rest nitrogen of the blood. The urobilin content of the urine showed no characteristic change.

Williams,<sup>14</sup> in 1922, reported the results obtained by employing the phenoltetrachlorphthalein test of Rosenthal in twenty pregnant women. One was in the sixth month, two were tested the first day postpartum, while the others were from seven to nine months pregnant. Fifteen of these patients were healthy, two were nephritic, while three were toxic patients with albuminuria who were evidently not nephritic. The dye was given intravenously, and the time of its first maximum appearance in the bile obtained through the duodenal tube was noted. In the normal cases this point was reached in from 16 to 24 minutes, with an average of 20 minutes. In the pathologic cases this period of time was variable, being 19 minutes in a nephritic patient with convulsions, while in the others the time was 20, 22, 25, and 28 minutes, respectively. In view of these variable results in patients in whom liver damage might reasonably be expected, the author concluded that further studies would be necessary in order to ascertain if the method has any value in such cases. It is interesting to note that in the nephritic case with convulsions, the appearance time was within the normal limits. This corresponds with case 10 of my eclamptic series (see table); this patient was really suffering from a very severe nephritic toxemia, and there was no retention of the bromsulphalein. I might also note that the duodenal tube method was soon superseded by a colorimetric method (devised by Rosenthal) of estimating the percentage of retention of the dye in the blood stream, and this latter method was employed by the authors mentioned below.

Smith<sup>2</sup> of the Boston Lying-In Hospital, employing the phenoltetrachlorphthalein test of Rosenthal, studied 20 clinically normal pregnant women and 44 pregnant women suffering from varying degrees of toxemia. In the former group he found occasional slight degrees of retention; in the latter group the test gave normal readings in 24 cases, while retention was noted in 20 instances. Of the 24 patients who reacted negatively to the test, 2 developed convulsions, one of whom died; autopsy revealed very slight liver damage. Of the 20 patients who showed retention of the dye, 5 had convulsions, while 6 of the 20 died from toxemia, operative shock, or infection (one case). Smith concludes that definitely abnormal dye retention suggests that the toxemia is severe, but that the percentage of retention does not in all cases parallel the degree of liver damage. As the severely toxic conditions will be readily recognized by clinical observation alone, it is possible that the chief value of this test in pregnancy will be as an aid in the classification of the milder toxemias.

Naujoks<sup>3</sup> employed this test in 20 patients suffering from the various toxemias of pregnancy, and reaches practically the same conclusions as Smith. He believes also that the test should be especially valuable in deciding for or against therapeutic abortion in cases of *hyperemesis gravidarum*.

Krebs and Dieckmann<sup>4</sup> used the Rosenthal test in a study of 37 patients with symptoms or physical signs indicative of varying degrees of the toxemia of pregnancy. They report no cases of eclampsia. Some of the patients gave normal readings and a few showed marked retention, but in the majority of instances the test indicated only moderate impairment of liver function, and the findings in the main appeared to agree fairly well with the clinical pictures presented. In two groups, however, one composed of patients with high blood pressure and no symptoms of toxemia, the other composed of patients with toxic symptoms but normal blood pressures, the test indicated dysfunction of the liver in most instances. The authors are of the opinion that such findings indicate a developing toxemia. In 6 patients who showed retention of the dye before delivery, the test 10 to 12 days postpartum was uniformly negative, while in 12 normal pregnant women it was uniformly negative. The authors feel that the test offers considerable promise in the study and management of the toxemias of pregnancy.

Rosenfield and Schneiders,<sup>5</sup> working with the same dye, found normal excretion in 6 cases of uncomplicated pregnancy. In 7 cases of hyperemesis gravidarum the test corresponded with the clinical picture, and in some instances disclosed impairment of liver function before it was manifested clinically. In 9 patients suffering from hypertension, retention in varying degrees was noted. The test returned to normal in every instance in which clinical improvement was noted. The authors feel that the test is of definite value as an index to treatment, particularly when therapeutic abortion or the induction of labor is under consideration.

Couinaud and Clogne,<sup>6</sup> employing the digestive hemoclasia test of Widal and the study of the excretion of glycuronic acid in the urine following the ingestion of camphor, advocate the determination of liver function by this method. Additional studies were made by them on the toxicity of the urine and on the intermittent renal elimination observed in cases of hepatic insufficiency.

Tallerman,<sup>7</sup> in studying the effect of the ingestion of levulose on the blood sugar, found no evidence of liver dysfunction in normal pregnancy. In three cases of the toxemia of late pregnancy studied by this method there was but one positive reading; this patient had a severe eclamptic attack.

Hyn and Messtorff,<sup>8</sup> working with the hemoclastic crisis test of Widal, found it to be positive in one-third of a series of healthy women in the last month of pregnancy. Didier and Phillips<sup>9</sup> obtained positive readings in 35 per cent of 26 apparently healthy pregnant women, and Kobarth<sup>10</sup> obtained a similar result in 56.2 per cent of 32 similar cases. Couinaud and Clogne also obtained positive reactions in the majority of healthy pregnant women upon whom they performed this test.

Of particular interest is the work of Berkeley, Dodds and Walker,<sup>11</sup> who studied the question of liver function tests in the toxemias of pregnancy as a guide to the induction of labor. They employed the Fouchet test for bile pigment in the blood, Ehrlich's test for urobilinogen in the urine, Schlessinger's test for urobilinuria, and Lowenhart's method of estimating the blood lipase. Control tests were made on known healthy students, as well as on patients definitely affected with various disorders of the liver. In 10 cases of albuminuria in pregnancy without toxic symptoms all tests were negative, and in no instance did a demonstrable toxemia develop. In 17 pregnant women with albuminuria and symptoms of toxemia the tests were likewise negative; the patients were allowed to proceed to term without induction of labor, and in no instance did eclampsia develop. Seven patients with albuminuria and definitely toxic symptoms reacted positively to all tests, and of these seven, four developed eclampsia before pregnancy could be terminated. I might add here that I have employed these tests (with the exception of the blood lipase estimation) in several cases of toxemia of late pregnancy, as will be detailed later, and I have failed to duplicate the results of these authors. One hesitates to differ with Comyns

TABLE I  
LIVER FUNCTION TESTS—ECLAMPSIA

AGE	PARITY	MAXIMUM BLOOD PRESSURE	N. P. N.	CREAT- ININE	URIC ACID	P. S. P.	VAN DEN BERGH	BROMSULPH.	EHRlich	FOUCHET	SCHLES- SINGER	REMARKS
24	1	180	34	1.4	3	33%	Neg.	40%. Trace 2 days P.P.	—	—	—	Severe case. Child dead in utero on admission
19	1	160	37	2	5	—	Neg.	Trace	Neg.	Neg.	Neg.	Mild, postpartum type, 4 convul- sions. Child stillborn prior to admission
34	1	210	Max. 75	Max. 3.53	Max. 8	—	—	5% 3 days P.P.	—	—	—	Very toxic, probably nephritic, 2 convulsions. Child stillborn. 2¾ lbs.
17	1	160	30	1.5	5.3	—	Neg.	Neg.	—	—	—	Mild, postpartum type. Developed puerperal psychosis. Child born before admission.
20	1	230	Max. 75	Max. 3.11	Max. 11.4	—	—	35%. 10% 8 days P.P.	—	—	—	Extremely toxic, hyperpyrexia, anuria. Child dead in utero on admission. 15 convulsions, coma
16	1	150	30	1.2	4.5	40%	—	Neg.	Neg.	Neg.	Neg.	Mild case, 8 convulsions, child lived
19	1	165	30	1.2	5	40%	—	7.5%	Neg.	Neg.	Neg.	Mild case, 10 convulsions, child lived
21	1	155	38	2.1	5	40%	—	5. %	Neg.	Neg.	Neg.	Mild case, 3 convulsions, child lived
17	1	160	39	3	2.5	35%	—	25 %	Neg.	Neg.	Neg.	Mild case, 9 convulsions, child lived
23	1	168	Max. 264	Max. 6	Max. 8	0%	Neg.	Neg.				Probably nephritic, 16 convulsions, died of bronchopneumonia

TABLE II  
LIVER FUNCTION TESTS—TOXEMIA WITHOUT CONVULSIONS

AGE	PARITY	MAXIMUM BLOOD PRESSURE	N. P. N.	CREAT- ININE	URIC ACID	P. S. P.	VAN DEN BERGH	BROMSULPH.	EHRlich	FOUCHET	SCHLES- SINGER	REMARKS
35	7	190	30	.8	5	—	Neg.	25%, later 0%	—	—	—	Bag induction. Child lived. 5 lbs. 3 oz.
39	7	165	30	1.5	4	50%	Neg.	Neg.	Neg.	Pos.	Neg.	Labor induced by Watson's method. Full term, child lived
28	3	200	37	2	5	37%	—	Neg.	Neg.	Neg.	—	Premature separation of placenta, death of child in first stage of labor
34	3	142	26	1.1	3	60%	—	Neg.	Neg.	Neg.	Neg.	Mild case; improving. Not yet de- livered
30	7	240	35	2	4	30%	Neg.	40% before delivery; 20% 2 days P.P. Trace 10 days P.P.	—	—	—	Bag induction. Stillborn twins, first anencephalic; second hydro- cephalic with spina bifida
20	1	175	37.5	1.2	4	48%	Neg.	Neg. twice before delivery	—	—	—	Bag induction. Child lived
26	3	190	57	2	6.1	20% twice	Direct delayed Indirect 4 units	Neg. error?	—	—	—	Chronic nephritis and myocarditis. Induction by catheter and piti- trin. Child died 1 hr. after birth
34	6	200	30	1.2	2.5	40%	—	Neg.	Neg.	Neg.	—	Full term, induction of labor. Child lived
23	6	190	37	2	4	35%	—	15%	Neg.	Pos.	Neg.	Induction of labor. Twins; first child macerated, second lived
40	7	170	92.1	2.6	7.24	5%	—	—	Neg.	Neg.	—	Chronic nephritis. Premature sep- aration of placenta. Child dead in utero on admission.

Berkeley, and it may be that further work will supply an explanation for my negative findings, but at present I can only record my results.

In this investigation I have employed the bromsulphalein test of Rosenthal and White,<sup>12</sup> the Van den Bergh and Fouchet tests on the blood serum, and the Ehrlich and Schlessinger tests on the urine. The Van den Bergh tests were performed by Dr. T. A. Tumbleson of the Department of Medicine of Tulane University, to whom my thanks are due for his cooperation. The study includes eleven cases of toxemia without convulsions, ten of eclampsia, and three of severe vomiting of pregnancy. A detailed consideration of the results may be of interest.

Bromsulphalein (phenoltetrabromphthalein sodium sulphonate) was introduced in 1925 by Rosenthal and White,<sup>12</sup> who claim that this dye has none of the disadvantages of phenoltetrachlorphthalein, which was previously popularized by the work of Rosenthal, who simplified and perfected the technic of its employment. Instead of the three readings necessary with phenoltetrachlorphthalein, only one is required when the new dye is used. Five milligrams per kilogram of body weight are injected intravenously; a blood sample is withdrawn at the end of half an hour, and the dye content of the serum is estimated with the aid of a special colorimeter. In patients with no pathologic changes in the liver no dye should be found at the expiration of this interval of time; if retention of the dye is disclosed by the test, the authors claim that the percentage of the retention parallels the degree of liver injury.

I found that this test, when employed in cases of toxemia without convulsions, was negative in the milder types, as well as in those patients whose toxemia was nephritic rather than preeclamptic in origin. It was positive in 4 cases, and in another instance a possible error in technic may have affected the result, though the negative reading might have been expected, as the patient apparently belonged in the nephritic group. One patient gave a reading of 25 per cent the day following delivery (labor had been induced by a bag), but a week later the test was negative. The second patient who reacted positively was very ill, and most probably belonged in the preeclamptic group, as evidenced by a nonprotein nitrogen reading of 35.1 and a systolic blood pressure of 240. In this instance the first reading, the day before delivery, showed a 40 per cent retention of the dye; the second test the following day gave a reading of 20 per cent; eight days postpartum there was still a slight retention, and it was not until the seventeenth day that the test was negative. In both these patients the test indicated severe liver damage, especially in the second case, and the findings coincided with the clinical pictures. The two other patients who reacted positively gave readings of 15 per cent and 25 per cent, respectively. The first was not very toxic, but

the second had a systolic blood pressure of 190, and there was considerable albumin and acetone in the urine. The test was not repeated in either case.

In the ten cases of eclampsia the test was negative in only three instances. One of these patients was suffering from a toxemia of a very mild type; in another patient with postpartal eclampsia the results were vitiated by an error in technic. In the third case there is no doubt that we were dealing with chronic nephritis complicated by convulsions. The phenolsulphonephthalein test was zero on two occasions, and the nonprotein nitrogen was 264 the day before death, which occurred six days after admission. This patient was the only one in the series who died, and the immediate cause of death was bronchopneumonia; the toxemia had been markedly improved.

The seven other cases gave readings varying from a trace to 25 per cent retention, and in every instance the percentage of retention agreed fairly well with the clinical findings and the laboratory data. In the three cases of hyperemesis gravidarum the bromsulphalein test gave positive results, varying from 10 to 25 per cent retention. Clinical improvement was apparently associated with lower readings, but definite conclusions cannot be drawn from so small a number of cases.

The Van den Bergh test<sup>13</sup> is based upon Ehrlich's diazo reaction and is both qualitative and quantitative. It also distinguishes between bilirubinemia due to obstruction of the biliary passages and that caused by increased destruction of the red cells by hemolysis. The standard matches a dilution of 5 mg. bilirubin per liter of blood volume. This is the unit of comparison. Normally there is found 1 to 3 mg. of bilirubin to the liter of blood, so that the normal reading is 0.2 to 0.6 units. In this study this test was found to be uniformly negative in the nonconvulsive toxemias, and in eclampsia as well, even though in many instances the blood was withdrawn immediately after admission, in the intervals between convulsions. In one patient in the nonconvulsive type, it is true, the test showed a mild grade of bilirubinemia of the nonobstructive type (2 units), but this patient presented a complicated clinical picture of chronic nephritis and chronic myocarditis, with increased fragility of the red cells, the cause of which could not be determined. On the other hand, the Van den Bergh test was positive in all three cases of hyperemesis gravidarum, and the readings paralleled the clinical findings.

Fouchet has devised a test for bilirubin in the blood serum, which is much simpler than the Van den Bergh test, although not so delicate. It detects bilirubin in a dilution of 1 to 60,000. Three drops of the serum are mixed on a white porcelain surface with three drops of the reagent (20 c.c. of water, 2 c.c. of a 10 per cent solution of ferric chloride, 5 gm. trichloroacetic acid). A white coagulum is formed, which, if the reaction is positive, turns a greenish yellow, reaching



the maximum color in about twenty minutes. This test was positive twice in six patients of the nonconvulsive type. In the first case, with a rather mild toxemia, the Van den Bergh test was negative, and we could find no explanation for the discrepancy. In the second instance, in which the Van den Bergh test was not done, the toxemia was of a severer type. In the eclamptic group the test was employed five times and in each instance the reaction was negative. It was not used in any of the cases of hyperemesis gravidarum.

The urinary tests for urobilinogen and urobilin are based upon the fact that normally these substances are absorbed from the intestines by the blood, are carried to the liver, and are there converted into biliverdin and bilirubin. If the liver is not functioning properly, this conversion is interfered with and these compounds are excreted in the urine. Traces of these substances are normally present in the urine, but the tests used in this work will detect only pathologic amounts. Ehrlich's paradimethylaminoazobenzaldehyde test is used in examining for urobilinogen, while Schlessinger's zinc chloride fluorescence test detects pathologic amounts of urobilin. These tests were employed in six patients of the nonconvulsive group and in five of the eclamptic group, with negative readings in every instance. They were not employed in the three cases of hyperemesis gravidarum.

From this review of the experience of others, supplemented by my personal observations, I feel that the following conclusions are justified:

1. Phenoltetrachlorphthalein and its successor, bromsulphalein, are of definite value as liver function tests in the toxemias of pregnancy. They are of service in differentiating between the nephritic and preeclamptic types of toxemia. The degree of retention seems to correspond with the clinical findings.

2. The Van den Bergh test is uniformly negative in nephritic toxemia, preeclamptic toxemia and eclampsia, except in an occasional case with excessive bilirubin in the blood caused by some independent condition. In hyperemesis gravidarum, on the contrary, it appears to be constantly positive for bilirubin of the nonobstructive type. This apparently substantiates the theory that the pathology of toxemic vomiting of pregnancy is essentially different from that of the toxemias of late pregnancy.

3. The Widal hemoclastic crisis test does not appear to be of value as a liver function test in pregnancy.

4. The Fouchet test for bilirubin in the blood serum has proved unreliable in a small series of cases of toxemia of pregnancy.

5. The same is true of the Ehrlich and Schlessinger tests for pathologic amounts of urobilinogen and urobilin in the urine.

6. The dye tests, as well as the studies on the blood sugar and on the storage and mobilization of glucose and levulose, indicate that in the toxemias peculiar to pregnancy there is definite impairment of the liver function.

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MAISON BLANCHE BUILDING.

(For discussion see page 611.)

## FUNCTION OF THE OVARY, A RÉSUMÉ\*

### FIFTH PAPER

BY ROBERT T. FRANK, A.M., M.D., F.A.C.S., NEW YORK, N. Y.

SINCE 1911 I have made it a self-imposed task at intervals to bring before the Society such advances as have been made in our knowledge of the ovary.<sup>1</sup> I am glad to be able to report that since my last paper, in 1924, substantial advance can be recorded.

At this, the fiftieth anniversary of the founding of the American Gynecological Society, it is appropriate to call attention to some papers of fundamental importance written by members of the Society or read before our association. In 1875 George J. Engelmann wrote a paper on "The Mucous Membrane of the Uterus,"<sup>2</sup> which is as modern today as when first published. He recognized the cyclical changes which were again rediscovered by Hitchman and Adler<sup>3</sup> in 1908. In 1877, John C. Dalton, in the second volume of our transactions, published a classic description of the human corpus luteum.<sup>4</sup> These are a few instances of early reports which unfortunately were pigeon-holed and forgotten for many years.

It is not necessary again to review the entire physiology of the ovary because the fundamental facts have become familiar to all of you. I shall therefore take for granted that you are aware of the work of the pioneers, such as Knauer, Halban, etc.,<sup>5</sup> and confine my

\*Presented at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 21 and 22, 1926.

exposition to the newest advances which, with a few gaps as yet unfilled, enable us to form a clear idea of the function of the ovary and its importance to the feminine organism.

The female gonads elaborate a hormone which has never been isolated in a chemically pure form but has been obtained in a sufficiently pure state to enable us to use it for pharmacologic and physiologic experimentation.<sup>6</sup> I feel no hesitation in assuring you that this hormone, which Gustavson and I call the "female sex hormone," is elaborated by the maturing follicle,<sup>7</sup> by the corpus luteum,<sup>6</sup> and perhaps by the placenta, although, as I wrote in 1917, the placenta may merely be a storage reservoir for the hormone elaborated by the ovaries.<sup>8</sup>

The hormone is of importance in fetal life and continues of vital significance until the menopause arrives. Contained in the placenta, this hormone affects the fetus in utero, producing stimulation of the mammary gland in both male and female, and in the female of the tubular system (vagina, uterus, and tubes) as well. In the infant and adolescent female the ovaries elaborate a small quantity of this female sex hormone although the dosage is extremely small and can barely suffice to exert the necessary trophic influence on the immature sexual organs.

With the first ovulation, which marks the onset of puberty, the maturing follicle elaborates larger amounts of the female sex hormone which, as I shall show later on, enters the circulating blood and stimulates the tubular tract to its first cyclical changes.

In 1917, as part of the symposium on internal secretions which was prepared for the Society, I had made notes to read to you of experiments then under way. On the day on which I was leaving for Pittsburgh, I was called into active military service and therefore was unable to present the new facts which I had just determined. I shall read the final paragraph as copied from the notes made at that time.

"The cyst fluid derived from the ripening follicles has a stimulating action upon the uterine musculature and mucosa. This last observation appears to give experimental proof of the contention of the physiologist that estrus is initiated by the ripening of the graafian follicles."

I had no opportunity of publishing this observation until 1922,<sup>7</sup> and since 1923 my findings have been amply confirmed by numerous investigators.<sup>9</sup> In the follicle fluid the female sex hormone is found in considerable concentration.

Years before this observation was made, the female sex hormone had been demonstrated in the corpus luteum and in the placenta,<sup>6</sup> in greater concentration in the latter than in the former. Although the presence of the hormone in the corpus luteum has not been confirmed by all investigators,<sup>10</sup> the fact that the chief doubters have now conceded that they can find the active substance in the human corpus luteum,<sup>11</sup> should be considered as decisive, because no physiologist or

zoologist can give serious consideration to the hypothesis of Allen, that the primate corpus luteum alone contains the hormone, for the corpus luteum is found from the monotremes up throughout the vertebrate series. The reason that it has not been demonstrated in the lower species by these observers is due to lack of proper methods of concentration.<sup>12</sup> Gustavson and I have explained the seeming incongruity that corpora lutea at the time of beginning involution contain more of the hormone than the recent more active corpora lutea, by pointing out the relation of the lutein cells to the capillary circulation which enables the active substance to enter the blood stream as it is formed, so that no storage takes place until the capillaries commence to obliterate.<sup>6</sup>

The next step was the demonstration of the active substance in the circulating blood (published by Loewe,<sup>13</sup> July 15, 1925, and independently by Frank, Frank, Gustavson and Weyerts<sup>14</sup> on August 15, 1925).

The female sex hormone, to repeat, has been shown to be elaborated by the growing follicles, the corpus luteum and the placenta and to be circulating in the blood in a demonstrable quantity at the time that the estrus approaches and during the beginning of the estrus. To this I may add that quite recently (report as yet unpublished) Goldberger and I have found the hormone in considerable concentration circulating in the blood of pregnant women, from the beginning of gestation to at least the sixth month of pregnancy. We have as yet not had an opportunity to examine the blood of patients further advanced in pregnancy.

Let us try to draw such deductions as are justified from these observations and see to what they lead.

Kingery, Gustavson and I<sup>15</sup> not only have shown that puberty may be induced in very immature animals, as previously known, but also that when the threshold of artificial puberty has been passed, the immature female organism is able and does continue this premature cyclical function without further stimulation. In the feminine organism puberty, therefore, sets in when the threshold of elaboration of the female sex hormone has been reached. The ovary, through its follicle, secretes the active substance. The tubular tract receives this substance through the circulating blood, responds to the stimulation by undergoing muscular and endometrial hyperplasia, the vaginal mucosa also responding to the effect of the hormone (Stockard and Papanicolaou<sup>16</sup>) (Papanicolaou<sup>17</sup>). These changes in the lower forms we are accustomed to call the preestrual change. In the human female these changes are familiar to you all under the name of premenstrual, better denominated pregravid reaction. In the animals studied the acme of the reaction is reached at the period called estrus at which time alone coitus is accepted; in the human female the passing of the highest point of the reaction is marked by menstruation.

It is now time to discuss some as yet unpublished results made by Goldberger and myself on the human female, which will shortly appear in the *Journal of the Am. Med. Assn.*<sup>18</sup> We have noted that the amount of the female sex hormone present in the circulating blood varies greatly during the menstrual cycle, an abrupt increase taking place especially noticeable one to two days before the menstrual flow is due, but present in some instances as early as thirteen days before the period occurs. The highest concentration is noted immediately before the onset of the period. With the onset of menstruation the hormone abruptly disappears from the general circulation (i.e., is no longer demonstrable by our present methods), but during the first day of the menses, sometimes during the second day also, the hormone is found in the menstrual excretion in a strength of from five to fifteen times that noted in the circulating blood.

Based upon these observations, the following generalizations can be made. They were enunciated by Gustavson and myself<sup>5</sup> even before these last corroborative observations had been added. The function of the adult ovary consists in elaborating a hormone which produces two types of cycles. The one we have called the fertile or complete sex cycle, consisting of maturation of the follicle with its attendant tubular reaction (pregnoid reaction), ovulation, impregnation, the elaboration of the corpus luteum, nidation, and pregnancy. Pregnancy is attended by the formation of a placenta which in turn sends the female sex hormone into the circulation and assures the continued hyperplasia of the uterus and accessory sex organs throughout pregnancy. Its acme is reached with the onset of labor.

The other, called the short, infertile or abortive sex cycle, does not differ from the fertile one until ovulation has taken place, impregnation for one reason or another having been prevented or not occurring. The corpus luteum then involutes rapidly and therefore the acme of the reaction is reached at estrus in the lower forms or at the time in the human female when the female sex hormone is excreted in the menstrual flow. It is, of course, evident and self-understood that the main, in fact the sole, function of the female sex organs is for the perpetuation of the species. To emphasize this function of follicle, corpus luteum and placenta, we call them collectively "the gestational gland."

Parenthetically I might add that the recent publication of Papanicolaou<sup>19</sup> in which he has demonstrated a hormone (if this be really a true hormone) obtained from the corpus luteum, which suppresses the maturation of the follicles and therefore interferes with ovulation, must be kept in mind. This substance if secreted at regular intervals might account for the rhythmic perpetuation of the cycle, a fact hitherto not fully explained by Leo Loeb's experimentation in which he showed that the removal of the yellow body produced an acceleration

of follicle growth and hence anticipation of the cycle, in addition to the formation of the maternal part of the placenta which he demonstrated as the function of the yellow body.<sup>20</sup>

On the other hand, Evans<sup>21</sup> has demonstrated that an extract from the anterior lobe of the hypophysis likewise represses ovulation. This investigator ascribes the cessation of ovulation in the rat as due to lutein cell transformation of the ovarian follicles.

It must also be remembered that in addition to the substances described by Papanicolaou and Evans, apparently quite nonspecific influences, such as changes in environment or food-supply may also interfere with the cycle. In one instance the blood of a human female contained a large amount of female sex hormone, such as is found just before menstruation (due four days later). The patient gave 500 c.c. of blood for transfusion of blood for her sick child. After this abstraction of hormone-containing blood, menstruation was postponed for fourteen days. For the present, therefore, we deem it expedient to leave the question as to whether the periodicity of the cycle is due to summation of the amount of female sex hormone following ovulation and corpus luteum formation until the yellow body becomes functionless, or to an inhibitory mechanism ascribable to either corpus luteum or hypophysis, or both, entirely open.

On this occasion I will refrain from describing again the physiologic methods of assaying by means of which it is possible to demonstrate the presence of the female sex hormone.<sup>22</sup> These methods are readily accessible in the literature. I do desire, however, to emphasize once more that Gustavson and I<sup>6</sup> have been able to demonstrate by three different methods that the hormones obtained from the follicle fluid, the corpus luteum and the placenta, are identical.

The blood test which Goldberger and I at present employ is still difficult, cumbersome and time consuming (the details of technic will soon appear, probably in the *Journal of the American Medical Association*). We hope to improve the technic so as to make it easier to use. The test has already proved of value (a) in differentiating types of amenorrhea, one type being due to absence or subthreshold quantity of circulating hormone, the other resembling the amenorrhea of pregnancy although impregnation has not taken place and which, at least until further evidence has accumulated, we ascribe to persistence of the corpus luteum; (b) in distinguishing certain types of menorrhagia and metrorrhagia, because it appears that irregular bleeding may be due to an over- or underproduction of the active substance. In one case of long persisting and severe prepuberty metrorrhagia, excess of the hormone was found in the circulating blood; (c) in the diagnosis of early pregnancy in which, however, the amenorrhea of pregnancy may have to be differentiated from the amenorrhea due to the persistence of the corpus luteum; (d) in the determination of sex in the

presence of malformation or hermaphroditism, on which a preliminary note will soon appear.<sup>23</sup> In two instances in individuals with absent vagina, and no palpable uterus or ovaries, the female sex hormone was readily obtained from the circulating blood. Further study may show additional uses for the test.

Since the presence of the hormone in the circulating blood has come to my knowledge, I have been more than ever impressed by the severe nervous and other symptoms from which certain women suffer before the onset of their menstrual period. These symptoms may be explained by the accumulation of an excessive amount of the female sex hormone in the system, particularly as these women almost unanimously notice that with the onset of the menstrual flow (through which the hormone is excreted) these annoying and sometimes incapacitating troubles are at once relieved. The symptoms in the main consist in a disturbance ascribable to the vagus nerve and the nervus pelvicius. This opens a broad field for further physiologic investigation.

In conclusion I desire to reiterate the fact that we have made no real advance in our attempts to employ ootherapy, although I feel more and more confident that sooner or later we will have at our command a new, potent and useful therapeutic agent. The really potent agent, I also feel sure, from the poisoning symptoms just described, will have to be employed with the utmost circumspection until we know its dosage and poisonous effects.

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10 EAST EIGHTY-FIFTH STREET.

(For discussion see page 617.)

## THE VALUE OF CAUTERIZATION OF THE CERVIX BEFORE HYSTERECTOMY\*

By B. Z. CASHMAN, M.D., PITTSBURGH, PA.

SINCE 1920, when Polak<sup>1</sup> advocated total hysterectomy in fibroid tumors there has been considerable discussion as to the advisability of doing total hysterectomy in all cases requiring removal of the uterus. Polak collected 256 case reports of cancer in the retained cervical stump after subtotal hysterectomy. All of those cases occurred more than one year after operation. Previous to this paper, subtotal hysterectomy was the operation of choice for benign conditions of the uterus, while total hysterectomy was undoubtedly the choice procedure in malignant conditions.

The chief advantage claimed for subtotal over total hysterectomy in benign conditions is that it is a less formidable operation. There is less extensive opening of the lymphatic spaces; the vagina is not opened; there is less danger of trauma to the ureters, and the exposure is less difficult, which in many cases must lessen the hemorrhage, shock, and danger of complications. In simple cases total hysterectomy

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tomy is not much more formidable than subtotal hysterectomy, but in stout patients with deep pelves, or extensive adhesions, or where there is marked fixation of the cervix by contracted parametrial tissue and uterosacral ligaments as a result of long-standing inflammatory processes in the cervix, or when there are large fibroids in the lower portion of the uterus, making exposure difficult, total hysterectomy is a very much more difficult procedure and with poor exposure there is more chance of hemorrhage, shock and of injury to the ureters, regardless of the skill of the operator. A less important advantage of subtotal hysterectomy is the preservation of the normal vault of the vagina.

The arguments advanced in favor of subtotal hysterectomy are valid, particularly in the poor surgical risks. On the other hand, the great advantage of total hysterectomy is that the cervix is removed. Cervicitis due to gonorrhea or secondary to lacerations is so common that in the majority of subtotal hysterectomies, a diseased cervix is left behind. As a result the patient may have leucorrhea, sacral back-ache, soreness in the pelvis and the other symptoms due to chronic lymphangitis or parametritis that result from cervicitis, and it has been shown that malignant disease occurs in the remaining cervical stump more frequently than was generally supposed. While emphasis has been placed upon removal of the cervix in operation for fibroids, are we justified in leaving a diseased cervix in any case requiring hysterectomy?

With these facts in mind we have attempted to secure the advantages of subtotal hysterectomy and eliminate its disadvantage, namely, leaving a diseased cervix. In November, 1924, the author<sup>2</sup> reported some histologic studies of the cervix after cauterization with the electrocautery. It was found that the cervical mucosa and glands can be destroyed in the majority of cases. The cervix was cauterized and immediately amputated in some cases. In others, previously cauterized cervixes in which healing had taken place were obtained for examination after total hysterectomy later. In these specimens, the cervical glands were completely destroyed.

The technic used differs from that originally advocated by Hunner<sup>3</sup> in that the cauterization is completed at one sitting. The cervix is dilated and the entire cervical canal is cauterized, and deep radial incisions are made at the external os, extending well onto the vaginal portion of the cervix. In this manner the cone-shaped, gland-bearing portion of the cervix is destroyed by a simple rapid method. If this is done as the first step in subtotal hysterectomy, there is accomplished practically all that is accomplished in total hysterectomy, and the disadvantages of total hysterectomy are eliminated. As a result of this procedure, the cervical mucosa and glands are destroyed, the cervix heals smoothly without a lumen and no after-treatment or dila-

tation is necessary, and the normal vault of the vagina is preserved. Although the most common point of origin of cervical cancer is in the vaginal portion of the cervix, if the infected cervical mucosa is destroyed the danger of cancer is eliminated, for cancer of the cervix does not occur in the absence of chronic cervicitis.

Another immediate advantage of cauterization of the cervix is that it insures a sterile field in cutting across the cervical canal in doing subtotal hysterectomy.

We have been using the cautery for seven years in the treatment of cervicitis, not only preliminary to subtotal hysterectomy but also in practically all operations for infected tubes, and in cervicitis without intraabdominal complications. We have not seen a case of carcinoma develop in a cervix treated in this manner, while in the last two years we have seen three cases of carcinoma of the cervix in patients who, within three years, had had pelvic operations in which an inflamed cervix was neglected. This is quite suggestive. The important point is not whether the patient has had fibroids or whether she has had subtotal hysterectomy, but whether a diseased cervix is present.

This method is applicable to all cases except in very extensive cystic disease of the cervix, where in order to reach all of the cysts so much of the cervix must be destroyed by the cautery that amputation of the cervix with the cautery is preferable. Cautery amputation of the cervix is a rapid, practically bloodless procedure and usually requires no sutures or ligatures.

#### CONCLUSIONS

1. Subtotal hysterectomy is a less formidable operation than total hysterectomy, but has the disadvantage of leaving, too often, a diseased cervix.

2. Cauterization of the cervix preliminary to subtotal hysterectomy destroys the infected cervical tissue and makes total hysterectomy unnecessary in benign conditions of the uterus.

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(For discussion see page 621.)

# Society Transactions

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## THE AMERICAN GYNECOLOGICAL SOCIETY

### FIFTY-FIRST ANNUAL MEETING

STOCKBRIDGE, MASS., MAY 20, 21, AND 22, 1926.

DR. HAROLD BAILEY, New York City, read a paper entitled **Trial Labor in 477 Cases of Contracted Pelves (Conducted under One Plan of Treatment during the Last Four Years)**. (For original article see page 550.)

### DISCUSSION

DR. FRANCIS A. GOLDSBOROUGH, BUFFALO, N. Y., (by invitation).—This paper of Dr. Bailey's is a very timely one, particularly for my end of New York State, because in the last few years the decision to do cesarean section there is based on apparently no particular thought or consideration so far as the outcome of a trial labor is concerned. It seems to me that in a great many instances the cesarean is decided upon because it is so much easier to say, this patient cannot have a baby and we will have to do a cesarean section than it is to study the case and see whether the baby can be gotten through the pelvis with safety.

In one of the hospitals in Buffalo 9 per cent of all patients were delivered by cesarean section, and to my mind there is no excuse for that. On account of the criticism of high forceps and of long tests of labor made a few years ago by some obstetricians, those less well informed in obstetrics have taken the point of view that cesarean is preferable but the results have not been good, as shown by Dr. Bailey.

In cases of but slightly contracted pelvis the patient should not be allowed to go over term and to have a very large baby. In such instances induction of labor at term will help in the outcome both for the mother and child.

In my part of the State of New York they are coming to the point where a breech presentation or a shoulder presentation even with normal pelvis is considered suitable for cesarean section. I should like to ask Dr. Bailey whether he attempts to make an estimate of the particular pelvis and the particular baby in a breech presentation; whether he would allow a labor to take place with the idea that he can determine in a given case that the aftercoming head will come through the pelvis, or whether it is a routine procedure in anything except the vertex presentation to do a cesarean?

Dr. Bailey's results in regard to the tests of labor are very excellent, and I agree with him that we can do the low section with very little greater risk than doing cesarean section earlier. If one will observe his cases carefully he will meet with the same agreeable surprises that Dr. Bailey has, namely that a large percentage will have spontaneous or comparatively simple delivery.

DR. ALEXANDER M. CAMPBELL, GRAND RAPIDS, MICHIGAN, (by invitation).—Dr. Bailey was kind enough to quote some statistics which we made in Michigan in 1913 concerning the mortality resulting from cesarean section. We have been

getting statistics on this subject for a number of years and while our last figures are not complete, so far as they have been gathered they show practically the same maternal and fetal mortality as Dr. Bailey reports from the State of Massachusetts.

Our latest statistics in Michigan show that cesarean section has a maternal and a fetal mortality each approximating 10 per cent. I assume that in this respect Michigan represents a cross section of every State in the Union and, therefore, think that Dr. Bailey is justified in sounding a warning note against the indiscriminate use of cesarean section. He states that there is a wave of meddling midwifery sweeping over the country and this is certainly true also for the Middle West.

I have been informed on good authority that in a certain Philadelphia Hospital one cesarean section is performed in every six pregnancies and that in a hospital in the city of Toronto only one cesarean section is performed in over 700 deliveries. These statements prove striking lack of unanimity in regard to this important problem.

I would not have the courage to permit a woman to remain in hard labor for twelve hours without either rectal or vaginal examinations because I want to know more definitely the degree of dilatation present. I would like to ask whether Dr. Bailey's test of labor means that the labor continues until the cervix is completely dilated and how he can tell the degree of dilatation without examination.

In every case of contracted pelvis we make an x-ray study which helps us to determine the safest means of delivery in the case. In every delivery we endeavor to maintain such a careful technic that cesarean section could be performed at any time with the minimum danger of infection. Concerning the newer transperitoneal low flap cervical cesarean section I doubt that within the near future it will supplant the classical operation. Dr. Bailey's statistics are excellent but the operation which he performs is more difficult, more time consuming and is associated with more hemorrhage, and these disadvantages must be taken into consideration. I believe that the ordinary operating surgeon will have just as high a mortality and just as much morbidity from the newer operation as from the classical.

Our own experience with the classical operation has been most satisfactory.

DR. BARTON COOKE HIRST, PHILADELPHIA, PA.—I find myself in full accord with the views expressed. There is no question that cesarean section is being much abused. A practice to be deprecated is referring these cases to a general surgeon with no knowledge of obstetrics. I was talking to a general surgeon in a small town recently who was boasting of the number of cesarean sections he had done. At a rough computation it seemed if his rate continued, one fifth of the whole population were being delivered in this manner.

For twenty years or more we have been following the custom of giving a primipara 24 hours of test labor and a multipara 12 hours and we have not seen any disadvantage to the woman or the child in a cesarean section which subsequently became necessary. It is not essential to do the low cesarean in all these cases of test labors: our statistics show about as favorable result with regard to mortality and morbidity with the old-fashioned high operation.

DR. WILLIAM C. DANFORTH, EVANSTON, ILL.—There is a tendency of late for cesarean sections to be done too frequently and the low cervical operation has also suffered from this in that it has been used no doubt in cases which did not require cesarean at all.

For the past three or four years we have been following essentially the same program which Dr. Bailey has outlined. All cases except those with absolute indications for abdominal delivery have been allowed to go into labor. They have

been given a true test of labor. Within the past month three cases of relative contraction have been so managed in private work with the result that all three delivered spontaneously or with a simple outlet forceps. We do feel, however, after having tried out both operations rather extensively, that the low cervical cesarean operation in a woman who has been in labor is preferable. The patients have a better and smoother convalescence and I am quite convinced that the risk of death is less, but it has the disadvantage of being a more difficult operation.

DR. FRANK W. LYNCH, SAN FRANCISCO, CAL.—The frequency of cesarean section is not confined to the East. I had the questionable pleasure of discussing a paper within the last two weeks of a gentleman of the coast who reported some 240 cases of cesarean section in a series of less than 4,000 labors, all of which his paper indicated had had the test of labor. It was rather embarrassing for me because in a series of approximately 6500 cases, we had done only 32 cesareans as opposed to his 240. I called attention to the fact that Dr. Reuben Peterson in 1913 calculated a tremendous mortality for the State of Michigan, and an assistant of mine, in 1922 had figured the mortality for California as 12 per cent, even though he had difficulty to complete the percentages because so many operators had refused to give their mortality figures.

DR. RUDOLPH W. HOLMES, CHICAGO, ILL.—We were all duly impressed when Dr. Reynolds many years ago showed that primary cesarean section was infinitely safer than a secondary operation. From the results of my work I convinced myself that it was relatively immaterial whether a woman was in labor or not, provided she was not exhausted, and provided that membranes had not been ruptured for a protracted period: supplementing this, interferences during labor increased the patient's hazards. I feel very strongly that a true test of labor only may be given if the membranes are ruptured—but the rupture of the membranes surely places the woman in jeopardy.

The fundamental defect of our teaching is that too much stress is laid upon the pelvic measurements, which are relatively unimportant, and do not accentuate the essential of cephalo-pelvic relationship: there is a great need for a precise method of mensuration of the head. After all that is said and done, the most efficient method of determining cephalo-pelvic proportion is a sane test of labor.

I believe x-ray is a very valuable adjunct to our methods of determining the cephalo-pelvic relationship.

I am glad that Dr. Bailey did one craniotomy as it confirms my contention that the operation is a perfectly legitimate one, even on a living child under exceptional circumstances: I have performed only one craniotomy on a living child in many years—and that was on a young woman who had suicidal tendencies before and during pregnancy, whose family was permeated with insane members. In her case, I felt, a craniotomy was more humane than a cesarean section.

DR. JOSEPH L. BAER, CHICAGO, ILL.—The time limit of twelve hours seems rather an arbitrary test, particularly in primiparæ, and I believe that twenty-four hours for primiparæ and twelve hours for multiparæ is a much more reasonable limit.

I believe that a 38 week induction in a multipara is an entirely legitimate procedure and often obviates the necessity for graver obstetric interference.

I wish to mention in this connection a case delivered a week ago at the Michael Reese Hospital. The patient was a multipara who had had a 28 hour difficult labor preceding this pregnancy, with successful termination by high forceps. I saw patient after labor had gone on for about twelve hours and made a diagnosis of face presentation with non-engagement. I recommended a low section but ordered as we do in pathologic cases as a routine, that an x-ray picture be taken before the

cesarean. The patient was ready on the table and the operators scrubbed up when the radiologist hurriedly brought a splendid picture showing an anencephalus. The patient was delivered vaginally four hours later.

DR. WILLIAM S. STONE, NEW YORK CITY.—It is rather surprising to me that in the discussion of this important obstetric problem more attention is not given to the consideration of the size of the fetal head. My thesis for admission to this society was entitled "Antepartum Measurement of the Fetal Head." The experience that I gained from carrying out these measurements with the ordinary pelvimeter enables me to estimate the size of the head with an accuracy sufficient to foretell the course of labor. Errors were very few. I would again urge more consideration of this part of the problem.

DR. JAMES R. GOODALL, MONTREAL, CANADA.—I do not think that any of us will take issue with Dr. Bailey's statement of the unnecessary frequency of cesarean section. But I think most of us will take issue with him in his methods of determination of test of labor.

The real test of labor begins only after complete dilatation of the cervix and rupture of the membranes. How does Dr. Bailey estimate the stage of labor after four hours of pains if he does not examine his patient digitally to find out?

Doubtless a very large percentage of Dr. Bailey's patients who underwent cesarean section after four hours of test labor were still in the first stage and therefore as far as the pelvic contraction is concerned had had no real test of labor.

DR. EDWARD A. SCHUMANN, PHILADELPHIA, PA.—I wish to introduce a note of dissension into this otherwise harmonious discussion. In the first place, the gross mortality statistics of cesarean section are valueless as a method of evaluating the elective operation. Such statistics include all neglected, "too late" cases, those performed by incompetent and inexperienced operators and have no bearing whatever upon the results of deliberate operations undertaken by specialists.

Now as to the relative mortality and morbidity of a long, manual or instrumental vaginal delivery as opposed to elective sections of any type. When one considers the number of women with sacro-iliac relaxation, with sagging pelvic organs and with ragged and irregular cervical orifices, results too frequently occurring in the practice of our very best men, one is tempted to believe that elective section carries with it no appreciable increase in mortality and an immeasurable improvement in morbidity.

It is absurd to condemn an operation and to seek to limit its employment, because of calamities occurring in unskilled hands, or because the procedure has been employed upon improper indication.

DR. LILIAN K. P. FARRAR, NEW YORK CITY.—It was the teaching and the practice of Schauta of Vienna, never to do a cesarean section on a primipara with a contracted pelvis if she had been long in labor, if the membranes had ruptured, or if she had been examined outside the clinic, but to give her a test of labor and terminate the labor by the vaginal route even if it meant the loss of the child, and in the next pregnancy, to do a cesarean section when labor was due, if the previous labor had been unsuccessful. It seems to me to be better obstetric teaching to give a patient a trial labor and then perform a selective cesarean section in the following labor. After having been an obstetric patient for twelve hours a woman is not fit to become a surgical case. We would not choose to perform a surgical operation on a woman who had been doing twelve or twenty-four hours of hard work, or who had any avenue open for infection.

DR. N. SPROAT HEANEY, CHICAGO, ILL.—What the general practitioner wants to know from a Society like this is how to tell when a baby can be born, and what constitutes a test of labor. Many cesareans are done because a patient has been twelve hours in labor and has not delivered. But we all know that under certain conditions such a patient if given a dose of morphine, may have labor cease for hours or days and deliver precipitately later. We should tell the physicians what really constitutes a test of labor, but there does not seem to exist any unanimous opinion even among us as to what really is a test of labor.

DR. J. C. LITZENBERG, MINNEAPOLIS, MINN.—I had not intended to discuss this paper but the remarks of Dr. Farrar induce me to speak. When Schauta was nearly 65 years of age he was asked by the Glasgow Obstetrical Society to write a paper on contracted pelvis. His paper was based on 80,000 cases of obstetrics. It was one of my duties to teach him how to deliver that paper and naturally I learned by heart what his conclusions were, and there has not been a word uttered today, until Dr. Goodall expressed his opinions which conformed to what Schauta considered a test of labor. Schauta's conclusions were that the test began not with the onset of labor pains, was not determined by any number of hours, but really started only with the completion of the first stage of labor.

I hate to disagree with Dr. Bailey in anything but I deery the fixing of twelve hours or any other number of hours as a test of labor. After the cervix is completely dilated a test of labor of eight hours is usually sufficient.

DR. HAROLD BAILEY, (closing).—I cannot attempt to answer all the questions and problems that have been brought up, but it seems to me that everyone who has spoken on the subject has taken a different angle.

Of course, the main point in the discussion is the number of hours for a trial labor, and the lack of knowledge, on our part, of the dilatation of the cervix, or perhaps even of the rupture of the membranes. You will recall that I said *twelve hours of strong pains*. This is quite different from primary inertia and the actual result in the average of these 37 cases, is a trial labor of 23 hours, or if we cut out three cases that were not under our control throughout the labor, the average was 17 hours. I think that emphasis on the term *strong pains* will satisfy everyone.

I believe that the vaginal examination is harmful. We are now using mercurochrome in the vagina and I believe the examinations will be followed by less morbidity.

Another point that has been mentioned is the difficulty of this particular type of cesarean section. I know that the time required is longer and I think it is a little more difficult.

At Bellevue Hospital we take all the operative cases from the two outdoor services so that the incidence of cesarean section should be rather high. We have an incidence of 1.7 per cent.

In breech presentation in contracted pelvis we do not permit trial labor. If we cannot turn the baby so that the head presents, we know that the removal of the aftercoming head will give a very high mortality for the child and therefore we do an elective section. We never take x-ray measurements; we know by looking at the woman what type of pelvis she has. We have never known it to fail that in the examination of Michaelis' rhomboid in a flat pelvis, the depression below the last lumbar vertebra drops so that it forms a triangle and not a rhomboid.

I wish to apologize to Dr. Stone who presented me with a Peret pelvimeter, because I was absolutely unsuccessful with it. I feel the size of the child with my hands and I consider this a better method of estimating whether or not the head will go through.

DR. HERBERT THOMS, New Haven, Conn., (by invitation) read a paper on **The Clinical Significance of X-Ray Pelvimetry**. (For original article see page 543.)

## DISCUSSION

DR. L. A. CALKINS, UNIVERSITY, VA., (by invitation).—I would like to ask Dr. Thoms whether he recommends this procedure as a routine measure, or reserves it for those cases in which he finds some degree of contraction, and how accurate he considers this method to be. Internal measurements of the superior strait obtained either by pelvimetry or by hand are supposed to be accurate to five millimeters or thereabouts. To be of any value the x-ray method must give the dimensions accurately to a greater degree than five millimeters.

I agree with Dr. Stone that it is essential to know more about the size of the passenger.

I had two cases recently in negro women both with moderately contracted pelves. On the one with a "very large" baby we did a cesarean section and obtained an 11½ pound baby; the other we allowed to go through labor and obtained a 9 pound baby through the birth canal.

DR. ALFRED B. SPALDING, SAN FRANCISCO, CALIF.—I will show some slides to demonstrate the method we use at Stanford to measure the pelvis by x-ray. This method was developed some years ago by Chamberlain and Newall and we have been using it for six or seven years with considerable satisfaction. A plumb bob is hung below the x-ray tube and two pictures are taken, using a 10 cm. shift of the x-ray tube between pictures. With these pictures in a stereoscopic viewing box, ink marks are made so as to correspond, stereoscopically, with the promontory, top of symphysis and all other points from which measurements are desired. The obstetrician should consult the plates to assure himself that these ink marks are correctly placed because it is in the placing of these points that the accuracy or inaccuracy of the method lies. The x-ray man can determine accurately the distance between any two points in the pelvis if we pick out the points.

Dr. Newall has developed a mathematical ruler to measure the distance between these points.

We have taken several hundred of these measurements and the point I wish to emphasize is that x-ray measurements are more accurate than the clinician's measurements with the pelvimeter. The x-ray gives somewhat larger measurements than are obtained with pelvimeters due to the fact that they are bone measurements and we must take allowance for that clinically. That is particularly true in the outlet measurements.

We should use in obstetric work the x-ray department more than we do. Many unexpected by-products are obtained in x-ray measurements. For instance, here is the original picture, that established the fact that it is possible to note the death of the baby by the shrinkage of the cranial contents.

DR. RUDOLPH W. HOLMES, CHICAGO, ILL.—This paper is a landmark in x-ray work in relation to obstetrics, however, I regret that Dr. Thoms has completed only half of the picture. He has given us a new and valuable means of determining the pelvic size and configuration, but the other half of the picture is wanting—the size of the fetal head in relation to the pelvis. I trust he will be able to depict and measure both pelvis and head in one x-ray picture. I have used the x-ray for years in the determination of the cephalo-pelvic relationship: I feel we have some criteria by the study of the amount of "corona" between the head and pelvic brim. I thoroughly appreciate that the head being nearer the tube—and the pelvis nearer the plate—there will be distortion but this interpretation of the corona has its due value.



DR. IRVING STEIN, CHICAGO, ILL.—In the last five years we have studied over 730 obstetric cases roentgenographically. We feel that the clinical data are of far greater importance than the x-ray data. A little deflection of the head, a little posterior rotation of the occiput, are of more significance clinically than are x-ray measurements of either the head or the pelvis.

The lateral pictures that Dr. Thoms showed are of exceedingly great value. I think we thus learn a great deal more about the sacrum and its form than we can ascertain by palpation; we have come to use the lateral posterior more frequently than formerly.

I disagree with Dr. Holmes concerning the corona. If the patient is radiographed in antero-posterior the head shadow will be exaggerated so as to apparently completely overlap the pelvis. A film taken in the postero-anterior will show less distortion. You can learn more by palpation and trying to force the head in from above than you can tell from the roentgenogram in these cases. The difference in the size of the fetus on the film in the two views described is often great; in the prone posture the fetus being nearer the film will give you a more accurate fetal shadow as to size whereas in the dorsal posture it will vary according to the size of the patient and the distance of the fetus from the film.

DR. HERBERT THOMS, (closing).—Of course, I agree that in the individual case the best pelvimeter is the baby's head, but I also believe that this x-ray method has its value not only for exact mensuration of certain dimensions but certainly also for the classification of contracted pelves. I do feel that it is accurate to one or two millimeters. That has been our experience in checking the method up. As a routine method I do not recommend or use it. It is simply for the case in which it is felt that more accurate knowledge of the superior strait is wanted. Lateral pictures are a great aid, particularly in the diagnosis of rickets.

DR. LILIAN K. P. FARRAR, New York City, presented a paper on **The Reaction of the Tissues to Radium in Treatment of Cancer of the Cervix, and the Importance of Lacerations in Producing Cancer in This Location.**

#### *Abstract*

In the Woman's Hospital in the State of New York, all ward cases of cancer of the cervix who have been treated with radium return for inspection once each month over a period of five years or longer if they can be persuaded to do so. The reaction in the cervix to radium treatment is so nearly uniform that we believe we know what the appearance of the cervix will be each month if the case is progressing favorably; and that we can tell when the expected effect of radium has not been reached and a subsequent dose is needed. In order that we might fully appreciate the changes taking place in the cervix after irradiation the medical artist has attended the follow-up clinic each week and made a series of sketches in water color of individual cases beginning before the patient has received radium treatment and then sketching the cervix at each successive visit to the clinic. The visits to the clinic are sufficiently far apart to show definite stages in the progress made by radium treatment.

#### **I. A Stage of Hyperemia.**

One week after the initial dose of radium has been given the tissues of the cervix, including of course the carcinoma and the adjacent mucosa of the vagina, are intensely red and hyperemic. The blood vessels are engorged with blood and it is for this reason that we do not consider that a case should be radiated if an immediate operation is imperative.

## II. A Stage of Slough.

One month after irradiation the cervix usually shows an extensive green slough and a foul discharge is now present. We believe that this slough must have entirely separated from the cervix before an hysterectomy can be performed without great danger of peritonitis resulting from cutting into this necrotic tissue. Cases occasionally come to the clinic a month after leaving the hospital and there is no appearance clinically of a slough nor of carcinoma, the cervix having healed more rapidly than the average case, while in others a slough may be present on the visit two months after leaving the hospital or possibly, though this is rare in favorable cases, a part of the slough may still be present on the following visit.

## III. A Stage of Healing.

We usually find the third stage, which is that of healing, is reached two months after radiation. The slough has separated leaving a smooth, clean, dusky red cervix which may be somewhat glazed but has clinically no look of carcinoma.

## IV. A Stage of Contraction.

The following month should show the fourth stage which is contraction. Large carcinomatous growths or even craters are contracted by the irradiation to a normal or smaller than normal sized cervix and the vault is as narrow as in senile vaginitis.

The selective and also destructive action that radium exercises upon cancer cells either destroys outright or stuns some of the cells but it is to the stimulating-to-growth of new connective tissue that we look for the inhibiting action of radium on cancer.

## V. The Stage of Marked Contraction.

Later visits show the fifth or final stage which is marked contraction. The increasing amount of connective tissue squeezes the tissues of the cervix until it is finally so shrunk that we are often asked if the cervix has been amputated. It is not until this stage has been reached that we are satisfied with the reaction of the cervix to radium. On the road to this goal we find at times that progress seems to have stopped and a second dose of radium is needed but usually the dose is less than the first and frequently only one or two needles of radium are necessary to check a nodule budding out in the cervix or vaginal vault.

It happens not infrequently when the cervix is small and shrunk and the internal os is tightly closed that the patient who has been making favorable progress up to this time, now appears in the clinic looking pale, perhaps septic and complains of abdominal pain or uterine cramp that even morphine has not relieved. A dilatation of the cervix is almost always followed by a gush of purulent or bloody fluid from the body of the uterus with immediate relief and improvement in the general health of the patient. This treatment may have to be repeated once or twice especially in young women who are in the age to have menstruation.

We have been impressed by the frequency with which lacerations were present in the cervix, and decided to study 300 of our consecutive case histories of cancer of the cervix to determine the incidence of pregnancy in this series of cases. In 288 of the 300 cases or 96 per cent, pregnancy (i.e. children or miscarriages) had occurred, leaving only 12 cases or 4 per cent who had never been pregnant.

It seems thus that repeated traumatization by labor or miscarriage might be a factor in changes terminating in carcinoma. Mention was made in nearly all the histories of hard labors or instrumental deliveries, and the specific statement was frequently met that the patient had been "badly torn" and "not repaired." In only nine instances in the 288 cases that had borne children was it recorded that "lacerations" were repaired and in six cases the repair had been made after the first delivery and no repair noted as having been made after the birth of the

next child. *In no instance was it specifically stated that the "repair" of laceration mentioned meant that the cervix itself was repaired.*

In more than one tenth of the series of 300 cases, cancer of the cervix had occurred less than five years after the last pregnancy, and in more than one fifth of the series cancer had occurred less than ten years after the last pregnancy.

The result of severe or repeated injuries in the cervical canal may be seen in the erosion or eversion of the lips of the cervix and in the cystic changes which take place in the glands themselves. Similar changes in the tissues elsewhere in the body are looked upon by pathologists as having an important bearing in the development of cancer. Should we not expect to find cancer developing in the cervix when similar conditions are present there as produce cancer in other locations? It seems only logical to ask why not repair the lacerations early? Much is being done medically in prenatal work to put the expectant mother in the best possible condition and so safeguard her for the labor, but are we giving sufficient surgical attention to postnatal conditions and especially to the injuries present after the delivery in the birth canal?

The practice of obstetrics is a surgical specialty and the obstetrician is or should be a skillful operator. The European "Frauen-Klinik" combines two specialties as one, and in no other way can the patient be adequately cared for than by an obstetrician who is also a gynecologist. Postnatal care of a patient should include repair of injuries to the cervix either by immediate, intermediate or secondary operation depending upon the extent of the injury, the condition of the patient, and whether the operation can be conducted with adequate assistance and aseptic technic.

With the increasing percentage of cancer of the cervix, is it not possible to lessen the menace of this terrible disease by turning back to the teachings of fifty years ago? Inspect the cervix of the recent mother and then employ a technic so simple that when performed soon after the injury has occurred it will restore the tissues to normal.

## DISCUSSION

DR. C. JEFF MILLER, NEW ORLEANS, LA.—For a number of years we were uncertain as to exactly what tissue changes followed the use of radium, but our knowledge in this regard has increased, and those of us who have had a large experience with irradiation can verify the gradual changes which Dr. Farrar has emphasized. The belief is still common that the changes which follow irradiation are due to necrosis. As she has pointed out this is not true; our good results come from the changes in the vascular connective tissue. Necrosis too often means that too large amounts of the radium element have been employed, or that the screening has been at fault. Such studies as these should be of great practical value in the matter of repeated exposures. We are too prone to resort to repeated irradiations without a survey of the tissue changes which the original treatment has brought about. In the hands of the inexperienced the bad results of irradiation may often be attributed to this very fact.

I also agree with Dr. Farrar that lacerations play an important part in the production of cancer of the cervix. We have by no means written the final chapter in the story of the neglected cervical laceration with the consequent chronic infection. Prenatal care of the pregnant woman is the greatest step forward which obstetrics has taken in recent years, but it should be pointed out that postpartal care is equally important. If within three months after delivery the condition of the cervix is carefully investigated, and erosions and lacerations attended to at once, the percentage of amputations of the cervix, Sturmdorf operations and similar extensive procedures will be largely reduced. All of them are necessary to correct the terminal stages of chronic inflammation, but trachelorrhaphy, or

sometimes simple cauterization, is frequently all that is necessary in the initial stages, although such procedures are useless when hypertrophy, fibrosis or cystic degeneration of the cervix are present. There is an unfortunate belief current, among general practitioners particularly, that such repairs should not be made during the child-bearing period. That is bad advice. Prompt attention to these matters will reduce the percentage of subsequent operative procedures, and I believe also that it will reduce the incidence of cancer of the cervix.

DR. GEORGE GRAY WARD, NEW YORK CITY.—This study which Dr. Farrar has presented has been a matter of very great interest to us in the cancer work we have been doing at the Woman's Hospital. We have a follow-up clinic which we consider a very important factor in obtaining satisfactory results in radium therapy. We personally attend this clinic every week, and all cancer cases which we have irradiated return at regular intervals of one month and are closely followed up, if delinquent, with the aid of the Social Service Department. We have thus been able to trace our cases with a considerable degree of accuracy. In our series which we presented before the American Medical Association last year we had 188 out of 196 completely followed up, losing track of only 8 cases.

The idea of recording the changes occurring after radiation by color sketches originated with Dr. Farrar and I at once saw the value of this and arranged to have our artist present at the clinic every week for this purpose. The cervix is exposed through a speculum electrically lighted, and the drawings are made with colored crayon directly from the patient. These typical pictures shown by Dr. Farrar give an excellent idea of the progress of the process as we see it at regular intervals, and we find that it is a matter of about three months before we get the final result of complete healing. It has been of great value in teaching us to appreciate what we may expect from irradiation. From observing these cases in this way at stated intervals we have learned what changes we should expect in a given time, and when these do not occur, or should a recrudescence of the disease show after healing, we are on our guard as perhaps that case will need a further irradiation to produce the desired result.

Another point Dr. Farrar has stressed is the importance of the prophylactic care of women after labor, as it undoubtedly has an etiologic bearing on the cancer question. We have in our series of cases quite a number of women in the child-bearing age who have developed cancer, therefore it is important that we should see that there is no condition left after a labor that will be a possible source of irritation, as it may be a factor in starting malignancy.

We believe that immediate repair of a lacerated cervix should be given serious consideration. During the last year or two there have been several papers written advocating this procedure. Reel of Columbus and Emge of San Francisco, and several others have recently written on this very point as to the importance of the immediate repair at the time of the labor. Women are now educated so that they come to the hospital to have their babies, and therefore the majority of cases can be taken care of under ideal conditions, with ample assistance and proper facilities. We do an episiotomy on many primiparas nowadays and we do not hesitate to suture that episiotomy wound at the time of labor, and it is very easy to inspect the cervix at this time, and the placing of the required sutures is a very simple matter and it should not, it seems to me, be a cause of more danger of infection than the episiotomy wound should be. I believe the fear of infection that some of us were taught is not warranted today under proper conditions.

The importance of the postnatal clinic should be emphasized and given more attention as Dr. Farrar pointed out and as Dr. Miller has just said. In the Woman's Hospital we have a postnatal obstetric follow-up clinic. Patients come back three times after their labor, at monthly intervals. At the end of the third month they are given their final examination and discharged. A visual examination

of the cervix should be made in order that its condition may be known so that the patient may have the advantage of treatment if necessary. I think it will be a distinct step in advance, if we repair these cases immediately, as is done in some clinics. Dr. Byron Goff of the Woman's Hospital has been doing this recently on a number of his cases and I think in a short time, we will have definite results to report with regard to this matter of immediate repair.

DR. WILLIAM A. SCOTT, TORONTO, ONT.—I have been very interested in the technic of radiation as developed by Dr. Farrar and Dr. Ward since their first publication. During the last three years I have ceased to operate on endocervical cancer. I still operate on cancer of the body of the uterus and on early cancer of the vaginal portion of the cervix. Their technic has appealed to me as very excellent in that type of case where one can see the primary growth, and therefore can trace out the action of the radium. But, unfortunately, that is not always the type of case with which we are dealing. If one finds the cancer starting in the cervical canal where, at the time of observation there is no invasion of the vaginal portion of the cervix, a different problem confronts us. If we radiate a growth in the cervical canal we cannot gauge the action of the radium as has been outlined here. This means necessarily two types of technic, one for cancer that is visible through the speculum, and a different technic for cancer that is not visible. One would hesitate to underradiate a cancer arising in the cervical canal, while one might not hesitate to give a smaller dose to a cancer that one could see. Therefore, up to the present, my technic has been the same for both forms of cancer, the very heavily screened radium, so that both the primary and secondary beta rays are eradicated with a heavy dose; and then, either with or without any symptoms or palpable findings, this dose is repeated at the end of three months. That is apparently about the right time according to the observations made, but I would like to know just how they treat in the Woman's Hospital the cases with endocervical cancer which are not visible through the speculum.

DR. JOSEPH L. BAER, CHICAGO, ILL.—Does Dr. Farrar advocate the routine inspection of the cervix after every delivery? I am inclined to believe that a spontaneous first stage without premature bearing down and spontaneous second stage should leave the cervix intact. An elliptical external os after involution indicates rather a physiologic nick, so to speak, of the cervix than a trauma which might lead to carcinoma later on. In cases that have run an entirely uneventful course, are the lesions ever sufficiently gross to make it necessary to reconstruct that cervix surgically?

DR. EDWARD A. SCHUMANN, PHILADELPHIA, PA.—I confess that I was surprised at the emphasis laid by Dr. Farrar upon the immediate repair of the cervix since we in the provinces have been taught to inspect routinely every parturient cervix and repair all lacerations immediately after labor just as we repair the lacerations of the perineum. In a very large number of easy, spontaneous deliveries there will be found considerable laceration, on the side to which the occiput was inclined, and the lacerations frequently extend almost to the base of the broad ligament. If it be true that exposure and repair of the cervix is not a routine obstetric procedure, any one who institutes this technic will be surprised at the large number of lacerations occurring even in spontaneous deliveries.

DR. GEORGE W. KOSMAK, NEW YORK CITY.—Several most interesting points were brought out in this paper. The main one, I think, is the obstetrician's responsibility at the time he dismisses the patient. The postnatal clinic advocated by the speaker is a most admirable conception and it would be an excellent thing if all obstetric departments would establish them. But even this would not by any means reach all of our maternity cases. The greatest amount of neglect in maternity

cases, in labor and after labor, necessarily occurs in those women who are not clinic patients. Unfortunately many obstetricians dismiss their patients at the end of two weeks with a casual bimanual examination in which cervical lacerations are diagnosed with the finger rather than by the eye. I don't believe that the exact condition of the cervix can be determined unless a speculum is introduced and the cervix carefully inspected. The important thing, however, is such an inspection not at the end of two weeks, but after four, eight or twelve weeks. It would be a better rule to see all our maternity cases, at these intervals. Only thus lesions can be discovered that are not noticed at the time of the patient's discharge from the hospital.

In addition to the lacerations there is another class of lesions that deserve as much attention as probable precursors of chronic inflammation and malignant disease later on. I refer to polypoid degeneration and erosions. Polypoid degeneration may undergo marked exacerbation during the later months of pregnancy. I think the cervix should be inspected also during pregnancy if there is any history of discharge or irregular bleeding, and in those cases we can be on our guard to institute the proper treatment after delivery. So much has been done with the electrocautery that every obstetrician should be equipped with this device in order to treat the polypoid degenerations and erosions as soon after the first month of childbirth as possible.

DR. ALFRED B. SPALDING, SAN FRANCISCO, CAL.—I would like to ask Dr. Farrar whether she has ever observed carcinoma developing in the scar of a trachelorrhaphy wound? Personally I have not seen it.

In the clinic at Stanford we have for five years had the junior internes repair the cervix following delivery. Eight days after delivery, the primiparas are inspected, and the interne repairs the torn cervix, the patient leaving the hospital on the tenth day. I believe this is a valuable teaching for the general practitioner. The trachelorrhaphy is quite superficial. I believe it prevents cervical infections and does not complicate future deliveries.

DR. C. H. DAVIS, MILWAUKEE, WISCONSIN.—Lacerations and other trauma of the cervix undoubtedly favor the development of chronic endocervicitis and thereby lead to more or less pelvic disturbance. Chronic irritation apparently increases the frequency of cervical cancer and with Dr. Farrar I believe the prevention and cure of chronic endocervicitis of great importance. However, in our obstetric follow-up we see relatively few patients with cervical lacerations which warrant operative repair. We use the cautery frequently on patients showing slight lacerations and early endocervicitis with most satisfactory results.

Dr. Farrar states that cancer does not develop where there was not a previous trauma. I recently reported the case of a 24 year old girl who came to me because of sterility. Examination showed an intact hymen. There was no history of previous leucorrhea or of menstrual disturbance with the exception that there had been a slightly increased flow with the last two periods, and a very little discharge between. After the hymen was dilated under anesthesia it was found that she had a small early squamous cell carcinoma of the cervix. We obtained a history of a maternal aunt having died at the age of 30 from cancer of the breast; a twin sister had been operated for toxic goitre, and this girl has an adenoma of the thyroid. We must take seriously the work of Maude Slye regarding heredity in the development of cancer, for while these chronic irritations are undoubtedly important, there are other factors which we are at present unable to control.

DR. FRED L. ADAIR, MINNEAPOLIS, MINN.—It seems to me that in advocating repair of the cervix we should not lay too much stress on the fact that we find carcinoma of the cervix much more frequently in women who have borne children without recognizing the fact that the women who have borne children are much

more numerous than those who have not. As a matter of fact, there is not much difference in the incidence of cervical carcinoma in nulliparous women and parous women in proportion to their number. I think this fact should be borne in mind regarding the conclusions about repair of the cervix so far as cancer is concerned.

We are not in the habit of making immediate repairs of the cervix in Minnesota. We have fear of contamination and we certainly see some cases of infection even without invasion of the vagina and an occasional fatality. Any manipulation through the vagina certainly does not lessen the frequency of infection. I have examined a good many cervices following delivery, and postnatal work is not new with us, but I haven't seen such large numbers of bad cervices after spontaneous deliveries. We see a good many erosions but some of the worst cervices that I have ever seen were those that had primary repair. I think it is rather difficult to repair the cervix immediately after delivery because it is distorted. The anterior lip is apt to be elongated. I believe we ought to be a little careful before we advocate this as a general procedure, especially among men who are going out to practice indiscriminately in homes and in hospitals. It might be well for an expert to do that sort of thing, but I think we should be certain of our ground before we undertake to teach students such a routine procedure.

DR. WM. C. DANFORTH, EVANSTON, ILL.—I am glad to hear Dr. Farrar's remarks on inspection of the cervix after labor. I was taught differently. I was told that the cervix was not to be repaired unless hemorrhage necessitated it. We find a considerable number of tears on inspection. I believe it is true that some of them fail to heal well because the suture is not put in with due regard to the anatomy of the tear. A suture that is put in near the edge, without taking into consideration the fact that the muscular part contracts, does not give the structure the support it needs. One should therefore put in a suture deep enough to grasp the muscularis, but without constriction. If one pays attention to this point, they heal up in a very satisfactory way.

DR. N. SPROAT HEANEY, CHICAGO, ILL.—Recently I saw a case in the ward at the Presbyterian Hospital, a woman married eight years, 30 years of age, who had had five children and after each one of the deliveries she had been operated upon by a "prophylactic" surgeon and a cervical repair done. Now in eight years of married life she had had five children, been in the hospital five times on that account and five times subsequently for repair of the cervix. When I examined her she had a marked retroversion and some prolapse of the uterus.

In my mind there is a question whether she has not now more chance of becoming carcinomatous as a result of five operations on her cervix than if she had had five babies in the hands of a midwife and been just ordinarily attended to.

DR. LILLIAN K. P. FARRAR (closing).—I will speak first of intracervical carcinoma. We have found frequently that intracervical carcinoma is often mistaken for an early carcinoma and it is not until we begin to dilate the cervix that we find there is an intracervical lesion. We use radium in exactly the same way as we do in the squamous cell type but place the radium a little higher in the cervix to cover the area involved and then employ the same technic in fastening the radium *in situ*.

The question of routine inspection immediately after delivery I think has already been answered by those who have been doing an immediate repair of the cervix. I have been interested in this since I began to look up the literature of cervical carcinoma.

As to the matter of hereditary carcinoma I found in reading the cancer reports in the recent survey that it is believed inheritance plays almost no part in the occurrence of carcinoma.

As to the frequency of carcinoma occurring in women who have borne children in comparison with women who have not borne children I am indebted to Dr. R. L. Dickinson for the information that 80 per cent of all women are married, and that 70 per cent of these bear children, which should make the incidence of carcinoma in married women approximately 55 per cent. The incidence however is 96 per cent in this series of 300 cases, and higher in other series reported, and probably really higher in this series, because many of the women who stated they did not have children, probably meant they did not have living children.

Now as to whether cancer has been observed in a repaired cervix and whether cancer is less likely to occur after five repairs, as in the case reported by Dr. Heaney. The presence of a tear in the cervix is frequently the cause of a one child sterility, thus the patient referred to perhaps might not have had the other four children if she had not been repaired. I have not been able to find anything in the statistics in regard to cancer occurring after a repair in the cervix but both Dr. Davis and Dr. Hirst have told me they have never seen cancer occur in a cervix that has been repaired. Dr. Davis has advocated immediate repair of the cervix for eighteen years and in reply to an inquiry wrote to me three days ago that he is still in favor of making an immediate repair of a laceration in the cervix. Dr. Hirst is still doing what he advocates—an intermediate repair.

Dr. Schumann said he had been taught to look for lacerations and to repair them at the time of labor. We have not had this teaching that he has been fortunate to have had in Philadelphia. I do not mean to imply that immediate repair of lacerations of the cervix is anything new. It is an old subject that has been up many times and discarded many times as impracticable but with more women being delivered in hospitals and more attention being paid to immediate repair of the lesions in the vagina and pelvic floor I have brought this subject up again in an effort to offset the increase of carcinoma in the cervix.

DR. FRANK A. PEMBERTON, Boston, Mass., (by invitation) read a paper on **The Relation Between the Treatment of Cancer of the Cervix and the Cell Type**. (For original article see page 536.)

#### DISCUSSION

DR. CAREY CULBERTSON, CHICAGO, ILL.—This is the first time so far as I know that this subject has been presented to this Society. Before the studies made by Martzloff, Pomeroy and Straus and others, it was believed that carcinoma originating in the cervical canal yielded to radium better than carcinoma in other sites. This paper explains in a large measure such belief.

The long continued spinal cell type, which we see in epitheliomas of the skin—carcinomas which really become chronic you might say, and where the patient lives for years, is not seen in the uterus. I have seen a patient in the last year whom I operated upon two years ago for procidentia. At that time she had had a carcinoma of the breast for fourteen years. She is still living. We do not see things of that sort in the uterus and we are not warranted, therefore, in giving the patient a better prognosis alone on the basis of finding a spinal cell type, rather than a transitional or a fat spindle cell or an adenocarcinoma.

DR. EMIL NOVAK, BALTIMORE, MD.—I believe that the essayist very properly emphasized the fact that the human factor, rather unfortunately, plays an important part in the scheme of classification by cell type. There are certain cancers which are definitely of the spinal cell type, and others which are just as definitely of the fat spindle cell type, but many cases will occur in which the cell type will be differently interpreted by different observers, as between the spinal cell and transitional, fat spindle cell and transitional, etc. Furthermore, it should



be emphasized that in order to draw proper conclusions one should study not one but many sections from each case, as one and the same cancer may show quite different pictures in different areas. For example, the growing margin not infrequently presents a picture quite different from that of the older and degenerating parts of the tumor. The same general statement applies to the interpretation of the proportion between stroma and cells.

In spite of these drawbacks some valuable data appear to have crystallized out of such work, particularly the fact that in the cervix, contrary to what might have been expected, the spinal cell group possesses a definitely lower grade of malignancy than the basal cell type. On other epithelial surfaces, such as the face, it is of course the basal cell type which is relatively benign. This work is in line with the work of Broders, whose studies of cancer cytology have led him to the conclusion that the higher the differentiation of the cell, the lower its relative malignancy. As the spinal cell is a highly differentiated type one is not surprised at the conclusions of Dr. Pemberton and also of Martzloff as to its lower degree of malignancy. The surprising thing is to understand why the spindle cell type is so much more malignant in certain other epithelial surfaces.

DR. FRANK W. LYNCH, SAN FRANCISCO, CAL.—Quite recently I had the opportunity to review the cases treated by radium which after five years were considered cured. I was astonished to find that there were 306 cases, treated with radium, with but 40 per cent of cures.

San Francisco holds the very unenviable position of having the highest cancer rate of any city in America. Of 250 cases seen in my small clinic, 107 have now gone through the five year period, and as we follow this work we realize that radium is not the method to be featured. If radium cures only 40 per cent of operable cases and 15 per cent of inoperable cases, there must be something beyond the action of radium itself. We have not been able to come to any conclusions concerning this factor. There is an individual variation in the type of growth, and in our 107 cases we have found a very large percentage of transitionals even though we have cured 60 per cent by radical operation. Repeated sections must be taken from the cervix, because a section from one spot does not necessarily reveal the essential lesion growing there.

DR. J. HOFBAUER, BALTIMORE, MD.—Since the work of Doederlein's clinic has been mentioned, I should like to discuss it inasmuch as I was associated with this clinic for some time.

We likewise reached the conclusion that the histologic findings in cervical carcinoma give no clue to the prognosis. We must also bear in mind that the excision of cancer tissue for biopsy is not devoid of danger, for this procedure may favor the spread of carcinoma cells.

Doederlein frankly admitted on several occasions his disappointment with the results obtained by radium treatment, and, at my suggestion, a new method was introduced in his clinic and has been practiced as a routine for the last three years.

It is generally admitted that progress in the radium treatment of carcinoma of the cervix is possible only if we are able, first, to render more efficient the defensive mechanism of the body against the carcinoma; and second, if we can sensitize the cervical cancer and make it more susceptible to the destructive action of radium rays. This was the problem. In our studies, we found that if we applied a third of the erythema dose of x-ray to the region of the hypophysis, an increase of about a million red cells occurred in the blood. A marked increase of the eosinophilic cells and of the cholin contents of the blood was also noted. The effect of pituitary radiation on the cervical carcinoma itself was demonstrated by the study of successive excisions of pieces of the carcinoma—the first excision

being made immediately after admission, the second a week after the radiation of the hypophysis. In the second specimen the carcinoma cells are found to have undergone a marked degeneration and the connective tissue showed a definite dilatation of blood vessels and a cellular reaction as well. The stimulation of the defensive forces of the body is thus demonstrated. This is quite in harmony with the statements of Sajous that the pituitary, through the intermediary of thyroid and the adrenals, may stimulate the defensive functions of the body. The patient, having thus been prepared by the radiation of the hypophysis now receives 100 milligrams radium bromid locally applied to the cervix in the usual manner.

The results in Doederlein's clinic have been summarized by Voltz, who claims that the new method has markedly improved the final results. The same method has of late as well been used in cases of carcinoma of the uterine body. (See *Münch. Med. Woch.*, 1925, No. 1; *Klinische Woch.*, 1925, No. 29; *Acta Radiologica*, 1926; *Zentralbl. f. Gynäk.*, 1926, No. 14.)

DR. WILLIAM P. HEALY, NEW YORK CITY.—At the Memorial Hospital we have so far been unable to regulate the radium and x-ray treatment of cancer of the cervix upon histologic findings. Dr. James Ewing at my request went over a series of my cases just within the last month, basing his findings entirely upon Roder's specifications. It was interesting to find that practically 88 per cent of our cases came into what might be called the transitional, or rather favorable group; 18 per cent of these were absolutely favorable, that is of the adult type of cell, the spindle cell that Dr. Pemberton refers to, 70 per cent were mixed transitional and spindle cell or adult type and would lean more to the nonmalignant than the highly malignant type of cell; the remaining 12 per cent were of the highly malignant, undifferentiated, embryonal cell type.

We find that the treatment of cervical cancer cannot be based in any way upon histologic findings; all that is gained is a prognostic point of view. You can say that an adult type of cell may have a better prognosis than one of the undifferentiated, embryonal type, but the treatment of the case must be, as Dr. Pemberton has said, based upon getting into the lesion the greatest total amount of radiation that you can get in safely, to bring about not only rapid regression of the primary lesion, but the proper kind of local tissue reaction. We feel that the tissue reaction is infinitely more important in the cure, or apparent cure, of the disease than the actual destructive effect of the radium on the cancer cells.

DR. FLOYD E. KEENE, PHILADELPHIA, PA.—In our clinic at the University Hospital we have been very much interested in determining whether or not the type of the predominating cell in carcinoma of the cervix might be of value from the standpoint of prognosis and I must confess that thus far we have been very much disappointed.

Doctor Kimbrough has recently reported upon 263 cases of carcinoma of the cervix that were treated over five years ago. Of this number the best immediate results were obtained in the basal cell type (58 per cent), the poorest immediate results in the transitional type (41 per cent), the best ultimate results in the prickle cell type, the poorest ultimate results in the basal cell type, while adenocarcinoma occupied the intermediate position. The higher malignancy of the basal cell type is almost entirely offset by its ready response to irradiation, thus making the final results practically the same in all.

DR. GEORGE GRAY WARD, NEW YORK CITY.—At the Woman's Hospital I had our pathologist study our cases from the viewpoint that Dr. Pemberton has presented and without knowing what the ultimate result of the radium treatment was, he finally reached the opinion that classification in accord with cell type was unsatisfactory as a prognostic factor, and that it could not be relied

upon, because the piece of tissue removed was often not sufficient to base an opinion concerning the nature of the cancer present in all parts of the cervix. In the prognosis a great many other factors have to be considered such as the patient's age, general health, stamina, etc.

DR. ALFRED B. SPALDING, SAN FRANCISCO, CAL.—I have given all cases of cancer of the cervix to the radium department for the last two years and have agreed not to operate for five years. Recently we reviewed the histopathology of over 100 of these cases and have observed some interesting facts bearing on the classification of tumor cells. Just as the essayist has said, we have observed that about 6 per cent were of the adenomatous type. The solid forms were studied according to the classification of Schottlaender and Kermauner and we found that 24 per cent were ripe, 30 per cent mid-ripe and 46 per cent unripe. Thirty-two per cent of the total showed "mixed forms," but in all of these one type of cell predominated. The unripe cancers of the cervix seem to be the most malignant type and have the greatest rate of growth so that a greater proportion when first seen will have extended to parametrium or vaginal walls. But they react better to radium treatment, and our cases of unripe tumors with disease limited to cervix have been cured. The ripe, on the other hand, although of slower growth and less malignant, seem more resistant to the effect of radium, in fact it seems as if radiation sometimes only results in accelerating the rate of growth. For this reason, we are inclined to doubt whether this type of tumor, when limited to the cervix, should be radiated at all, but rather be treated solely by radical operation.

DR. FRANK A. PEMBERTON (closing).—I agree with the speakers that it is difficult to classify these different types of cells. We also feel that the transitional group is the dumping ground for the others.

What I wanted to bring out especially was that the dosage should not be varied according to the type of cell, but that the patient should get the full dose every time. I believe this gross classification is the one that has been adopted by the American College of Surgeons.

DR. W. A. SCOTT, Toronto, Ont., read a paper on **The Present Status of the Induction of Labor by Means of Pituitary Extract.** (For original article see page 571.)

#### DISCUSSION

DR. JOHN O. POLAK, BROOKLYN, N. Y.—The red flag of danger should be put up against pituitary extract. A fetal mortality of thirteen in 198 inductions is something that must be considered. When should we induce labor? When are we justified in doing it in the light of a 6 to 7 per cent fetal mortality, when we can get a 2.1 per cent mortality or less in our general obstetric practice by intelligent expectancy? There is in my opinion no place for induction of labor in contracted pelvis. The overgrown child is made a good deal of, and yet we all know that many of them will pass through, and those that will not, will come out better by section. Therefore, I want to enter my voice against any plan of induction of labor because all methods of induction of labor carry with them a greater morbidity and an occasional mortality.

DR. W. A. SCOTT (closing).—The point that Dr. Polak made is the point that I tried to cover in the first paragraph. The indications for induction were not considered in my questionnaire. They vary greatly but, as I pointed out, there is no question at all that if the general medical public feels that they have a method that is easy of technic and safe for both mother and child, many more inductions

will be done than if they feel that the method of inducing labor is not easy and that it does carry with it some danger. Therefore, I think that warning is very well given. I do feel, however, that one should not indiscriminately refuse to induce labor. If the condition that is existing in a given patient carries with it a greater danger than the induction of labor, then I feel that induction of labor is indicated and in my own practice I do attempt to follow that principle. It is, therefore, only an error of judgment if I induce labor too frequently.

DR. E. L. KING, New Orleans, La., (by invitation) presented **A Preliminary Report on Liver Function Tests in the Toxemias of Pregnancy.** (For original article see page 577.)

#### DISCUSSION

DR. OTTO H. SCHWARZ, St. Louis, Mo. (By invitation).—Dr. King has selected the two tests for liver function, or at least for some phase of liver function, which have been recently reported by several authorities to be the most valuable. Carl Greene of the Mayo Foundation and his coworkers have come to the conclusion that the phenoltetrachlorophthalein test and the Van den Burgh test are the most valuable. The former was first used by Rosenthal. He has recently substituted bromsulphalein, the dye which Dr. King has used.

In the study of Greene and his coworkers, which involves chiefly cases of jaundice, due both to benign and malignant causes, the dye test and the Van den Burgh test ran parallel as indicating the degree of impaired function. Interesting in Dr. King's work is the fact that he has found the Van den Burgh test negative in cases of preeclampsia and eclampsia, in which the liver involvement would be expected to be chiefly in the periphery of the lobule; the dye test showed impairment here. In cases of early toxemia, in cases of severe vomiting, in which the central portion of the lobule is involved, both tests ran parallel.

Our own experience with these tests has been limited to the phenoltetrachlorophthalein test. In the main, our findings agree very well with the results of Dr. King. I have recently consulted Dr. Dieckmann, who has been carrying out this work, and he feels at present, that at least in early pregnancy the test runs parallel to the glycogen content of the liver. If we have a liver with marked fatty infiltration the test will show a marked impairment. By the ingestion of large amounts of carbohydrates the fatty infiltration usually promptly disappears and the liver function test approaches the normal. Dieckmann feels that in this way one can watch the early toxemias of pregnancy, clinical improvement running parallel to the degree of impaired liver function as indicated by the test. We have had several cases in which the test has proved unusually interesting. In one instance it was negative in a very severe case of nephritic toxemia in early pregnancy. The patient had a marked hypertension and a large amount of albumin in the urine. She was well known as a nephritic before her pregnancy. In another case, a fatal case of eclampsia with convulsions in which the liver at autopsy showed a marked lesion, there was absolutely no retention of the dye.

DR. EDMUND B. PIPER, PHILADELPHIA, PA.—I am glad to learn that Dr. King has much the same feeling about these tests that I have had and Dr. Schwarz has, that is, they are not absolutely paramount. Such a test unquestionably has its value and its place, as I see it, in the cases of hyperemesis gravidarum. Possibly it would help us to know the time when to terminate pregnancy, if it is necessary. I don't believe that laboratory tests will ever clearly designate what we should do in the treatment of eclampsia or the preeclamptic state. To best illustrate that, take the type of case I have always been taught to look upon as the liver type of toxemia, or the low pressure type in which there is no rise of

blood pressure, very little if any albumin and not many of the clinical symptoms. I remember one case well which was seen in the out-patient department of my dispensary at the Philadelphia Lying-In Hospital, in which our records showed that within three days she had a blood pressure of 115, practically no albumin and no symptoms. She came to the Hospital at midnight, complained of nothing except that she thought she was in labor. She was not progressing rapidly and was allowed to go back home. She returned at 3 o'clock definitely in labor. At 7 o'clock she had a convulsion and was dead in an hour and a half. What liver function test could control a case of that character?

All studies in liver or kidney function tests may be of great value, but we must not forget the clinical picture that goes with it.

DR. J. HOFBAUER, BALTIMORE, MD.—The signal importance of liver changes in the toxemias of pregnancy was first emphasized in my monograph on the "Toxicoses," and I was able to adduce evidence that in hyperemesis we have to deal with glycogen deficiency of the liver and of the placenta as well. Based on the severe disturbance of the carbohydrate metabolism, a functional liver test by the use of levulose was suggested. I still maintain that appearance of levulose in the urine after the oral administration of 40 grams of levulose indicates an ominous damage of the liver. As to the experimental production of liver changes closely resembling the changes encountered in cases of pernicious vomiting, I refer to a paper recently read before the New York Obstetrical Society.\*

Another valuable liver test, based on the same principle as the levulose test, consists in the persistence for more than three hours of hyperglycemia after the oral administration of 20 grams of glucose.

An exceedingly high level of bilirubin in the blood is characteristic of severe cases of eclampsia.

DR. JOSEPH L. BAER, CHICAGO, ILL.—We have all been taught to regard eclampsia as either nephritic or hepatic in origin. We have all tried to treat eclampsia by prevention rather than by cure if possible. The urologists and the internists have recently been urging the value of two renal function tests which may be correlated with the hepatic function tests in this discussion. They claim for them a delicacy far beyond anything brought out heretofore for renal function. If it is true that these tests reveal renal dysfunction in women, apparently well, then the hypothesis which I advanced before the Chicago Gynecological Society this spring might be worth considering, namely: "*that the woman does not become nephritic because she is an eclamptic, but becomes an eclamptic because she is already a nephritic.*"

DR. E. L. KING, (closing).—There are one or two other points that I want to mention that I did not put in the paper because they were not really germane to the subject. We have found in eclampsia the uric acid of the blood being high. The sickest patient that I had, showed a blood uric acid of 11.4. She had 15 convulsions, a blood pressure of 200, temperature of 106° and anuria. She recovered. We have found that the uric acid in the blood corresponds roughly to the intensity of the toxemia.

There is one danger that has been mentioned in regard to the use of these compounds in testing liver function, and that is that they may break down in the liver and give rise to the corresponding halogen acids.

Another point to stress is that there must be considerable liver damage before these tests show any reading.

Dr. Piper mentioned the annoyance of multiple puncture of the veins. We work it in this way: When we proceed to make these tests we make one puncture with

\*See this Journal, issue of August, 1926.

the needle, taking out the blood for the Wassermann, for the blood chemistry and for the Van den Burgh test, and give through the same needle the Rosenthal dye. Another puncture is made  $\frac{1}{2}$  hour later to get the serum for the Rosenthal test. So we only make two punctures for the various tests. If positive, we will repeat the Rosenthal test in two or three days, but not oftener than that.

I believe the test will be of value in two ways: first, in helping to determine for or against the induction of abortion in cases of hyperemesis. Then, secondly, it will be of value in assisting us to differentiate between preeclamptic and nephritic toxemias. I believe we can be more conservative in inducing labor in nephritic toxemia so if we can differentiate, we can wait a little while in the nephritic type, whereas it would be dangerous to wait in a case of the preeclamptic type.

DR. R. R. HUGGINS, Pittsburgh, Pa., read a paper entitled **Ligation of Pelvic Veins in Thrombophlebitis**. (For original article see page 562.)

### DISCUSSION

DR. N. SPROAT HEANEY, CHICAGO, ILL.—May I ask Dr. Huggins if he will describe to us a typical hypothetical case in which he would feel that a ligation of the thrombosed vessels would be indicated, because I fear otherwise the discussion will go afield. For my part I would like to have the discussion limited as much as possible to the type of case for which Dr. Huggins would advise operation. I would like to ask before the discussion of the paper whether he ligated the vena cava, or was that a misstatement?

DR. R. R. HUGGINS.—I am very sorry that my paper is not clearer. This is the kind of a case that I am talking about: A patient is seen four or five days after the onset of temperature. There is a history of one or more chills, a fall of temperature to  $99^{\circ}$  followed by rise to  $104^{\circ}$  to  $105^{\circ}$  and even as high as  $106^{\circ}$ , recurring day after day with an absence of any causative findings in the pelvis in the nature of an extensive infection within the broad ligaments secondary, of course, to a spreading lymphangitis, and absence of positive blood culture findings under ordinary methods. The last case reported was operated upon by my associate, Dr. Cashman. In this case, the pus in the vein contained a pure culture of the colon bacillus. Generally, blood cultures are negative and this is one of the strongest points in the differential diagnosis. With such a patient, the symptoms going on from day to day, without signs of improvement but apparent evidence that the patient is slipping, operation under these circumstances is in my opinion justified.

The vena cava was ligated in one of the bad cases. The patient lived for two weeks without any more swelling than she had before the operation, because the common iliaes were both plugged with clots. The complete plugging of the veins was in this instance equivalent to ligation.

DR. O. PAUL HUMPHSTONE, BROOKLYN, N. Y. (By invitation).—Dr. Huggins has for years persistently urged the availability of this treatment for pelvic thrombophlebitis. Possibly the syndrome which he has just described may solve the point upon which this procedure has hung for many years; namely that the indications for surgical intervention are so difficult to determine that the results of operative treatment are no better than nonoperative treatment. However if I understand him correctly, the mortality in his cases is just about the same as it has been.

May I just cite some factors which make this treatment illogical, in my opinion: first, the multiplicity of the veins out of the pelvis. The only place where this surgical procedure has been successfully applied is where there is only a single emissary vein. We believe that there are occasional hematogenous infections of

these veins in the pelvis from distant focal infection. We believe the greatest advance in the management of this condition in the last ten years to be in prophylactic treatment, first by primary repair of all cervical injuries; and if we put a little mercurochrome in there, we believe the danger of infection is further diminished. Second, by the adoption of the principle of a continued complete contraction of the uterus after labor. Infections of thrombi in the sinuses are very much less likely to pass out through the veins of the uterine wall if the uterus is kept firmly contracted.

In Brooklyn we have had considerable success by treating these cases with small repeated transfusions; direct transfusions of not over 250 c.c. about every four or five days with a very carefully matched and typed patient.

DR. JOSEPH BRETtauER, New York City.—Dr. Humpstone has expressed my sentiments only in part; he has tried to make it appear an easy problem to diagnose this pathologic condition, but I must confess that my experience has taught me the contrary.

The patient who died with an abscess in the pelvis is not a case for discussion here.

I believe that those of you who are engaged in special work in the big centers, will agree with me that the occurrence of this condition has decreased decidedly in the past fifteen years, and even without the hospital records at hand, I can state definitely that it has become rather rare. Twenty-five or thirty years ago, we saw a great many cases in New York City.

I operated upon my first case in 1909, and went at it hesitatingly. It was one of those very bad cases, exactly like the one shown on the screen a moment ago. An incision was made and both ovarian veins were found filled with blood; I ligated and cut through with the cautery; there was no sign of a thrombus. The patient had no chill for thirty-six hours, but died after five days; at autopsy the vena cava was found filled with pus. There was a small lateral thrombus which did not entirely obstruct the lumen, but there was practically no fluid blood up to the diaphragm.

Of course, you may say that the process started in the pelvis, and that we were weeks too late in our attempt to cure the patient by operation; I have operated since, however, and at autopsy have seen this very type of case with perfectly free ovarian veins, and without thrombi in the pelvic veins. If nothing can be felt in the pelvis and if the blood culture is negative, an exploratory incision is an entirely different proposition. An abscess which could not be detected by bimanual examination, may be found in any of the internal genital organs, and be the cause of the condition.

DR. REUBEN PETERSON, ANN ARBOR, MICH.—In the early nineties I thought I had solved the problem of puerperal infection by early removal of the uterus. I performed the operation a number of times but with indifferent success. The trouble was that my reasoning was wrong in that I was dealing with a blood stream infection which was affected very little, if any, by removal of the uterus.

I am afraid Dr. Huggins' suggestion of tying off the pelvic veins for puerperal infection is also based upon pathology equally wrong. It is what we would like to do, treat these cases surgically, if we could be convinced that it would do any good. As Dr. Humpstone has said, there are many infected veins in these cases and it would be difficult to decide which veins to tie. The main argument against the procedure is, in my opinion, that we are dealing with a blood stream infection when the damage has been done and tying of veins would do very little, if any good and probably would do harm to a patient already badly handicapped by severe infection.

DR. OTTO H. SCHWARZ, St. Louis, Mo.—I know of no phase of puerperal infection in which accurate bacteriology is so important as in severe cases of thrombophlebitis. Although anaerobic streptococci were isolated as early as 1895, it was not until the work of Schottmueller in 1910 that these organisms were considered as playing an important part in the etiology of puerperal infection. These organisms are particularly apt to cause thrombophlebitis. They have the property of subsequently dissolving the thrombi, small particles breaking away which give rise to the spread of the infection, involving particularly the lungs.

Schottmueller has reported many cases. He has also attempted ligation, feeling that to get any sort of results it is necessary to ligate the internal iliac veins on both sides, as well as the ovarian veins. His results have not been sufficiently good to advocate the operation to any great extent. He emphasizes that if ligation is to be successful it must be done early, that is, not longer than two weeks after the onset of the disease. It seems to me that this is a point which gives rise to the greatest difficulty, because a good many cases if left alone will clear up spontaneously, and those which are ligated late in the disease give very poor results.

We have been growing our bacteriologic cultures both under anaerobic and aerobic conditions. We have had three interesting cases of blood stream infection in which anaerobic streptococci were recovered from both the uterus and the blood stream. These cases we had hoped to cure by repeated transfusions. They all developed lung lesions. One of these cases recovered and two died from pulmonary complications in spite of numerous transfusions.

The indication for ligation, in my mind, would exist only in those cases which are definitely due to anaerobic streptococci and not due to the ordinary pyogenic organisms; and secondly, that ligation be performed only in those cases at such a time when the lung lesions make their appearance, in the hope of preventing further dissemination of thrombotic particles, and by good supportive treatment in addition give the patient a chance to combat the infection as it exists at that time.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—There is one correction I would like to make in regard to the cause of thrombophlebitis. My impression is that it originates in the placental site and that the relaxed uterus with a vaginal flora represents the etiology in a very large number of cases.

In regard to the point that Dr. Huggins has so well brought out, I am frank to say that he has not made it one bit clearer to me *when I should operate*. I have operated under just the indications that he has, and have had a mortality higher than when we did not operate.

I have once in a while, probably once in two or three years, yielded to the temptation of doing surgery in these puerperal cases, and then my pathologist and I go over the material and are surprised to see how I have disseminated the infection through the barriers that nature has put up.

DR. EDMUND B. PIPER, PHILADELPHIA, PA.—I want to ask Dr. Huggins if he has ever asked these patients if they had a pain in that side for six or eight weeks previous to confinement? I have found in some cases where a lesion developed on one side, that there was a pain on that side previous to confinement, and there might have been a focus of infection in the general organism before this one lit up.

I believe that multiple incisions, or any incision, where there is no pus, may change a condition which is taken care of by the lymphatics into a blood stream infection. Some of the gentlemen who have discussed this paper have apparently gone on the hypothesis that there was blood stream involvement in the cases that Dr. Huggins spoke of. I thought he was speaking of the cases that had definitely no blood stream infection. When ligation is done the veins must be opened and thus you will enhance the chances for a blood stream infection.



DR. C. JEFF MILLER, NEW ORLEANS, LA.—In 1917 I made a collection of all the material on this subject reported in the literature, and even secured the autopsy reports in detail to see just how far we were justified in performing this operation. I had had one or two very dramatic results from ligation of the veins, and I thought the study might be of value. When I had collected all the reports and saw the variety of the veins involved, I began to be skeptical about the operation, and after I had done about five cases I became more conservative and have not done a ligation since. If the operation is done early, it is frequently unnecessary, if it is done late, it is always useless. In the cases where only one vein was involved, as the ovarian, ligation would often control the infection. When the internal iliacs were involved and ligation was done, the mortality was much higher. When ligation of the external iliacs was indicated, the recoveries were few. The series included a few cases of ligation of the vena cava, and I cannot recall that a single patient lived after the operation.

There are undoubtedly cases in which ligation of the thrombosed veins will ward off a fatal issue, but the pitfalls of diagnosis, the difficulties of deciding on the proper time for operation, and the fact that so many of these patients recover without interference make one hesitate to resort to the operation very often. Theoretically it should be done when the condition is acute, which will mean that many unnecessary operations will be performed. On the other hand, when the chronic stage is reached, the veins are often crumbling and perivenous pathology exists, so that simple ligation is not indicated. Resection of the veins, however, increases the risk to the patient and is not generally a satisfactory procedure. Pulmonary and cardiac lesions are definite contraindications.

The operation unquestionably has a definite field, but it is a very limited one, and I cannot agree with Dr. Huggins that it should be the rule in septic thrombophlebitis in the early stages.

DR. HIRAM N. VINEBERG, NEW YORK CITY.—This paper has gotten so many knocks, and as I feel that I am partly responsible for having introduced this operation in this country, I might say a few words in its defense.

I reported the first case in January, 1908, probably the first case done in this country. Then I presented a paper on this subject in 1910 to this Society. I said from the outset that the difficulty was in determining what were the indications. I am given credit for having considerable clinical sense and I may say for myself that in those cases upon which I operated the pathologic conditions of the uterus and the pelvic veins showed that the patient's chances of recovery were rather small.

Now the diagnosis of the condition is very simple. You see these excursions of up and down temperatures, chills may be present or not, and very little is to be felt in the pelvis or even through the abdominal wall. To wait until the disease reaches the vena cava and then operate, when there is a retrograde process, when the legs are swollen from the thrombosed vessels, is unwise because then the disease has passed beyond control. If there is real infection of the veins—and I have operated on cases in which the ovarian veins were as thick as my thumb—merely passing a ligature around them does not seem to be sufficient. I have always excised them, and in some cases as high up as the vena cava.

In the ten cases upon which I operated, as far as I can recall, there were six recoveries.

DR. FRANK W. LYNCH, SAN FRANCISCO, CAL.—If I understand it correctly, the essayist has only seen indications for this operation twelve times in fourteen years, which is, of course, something we should think of.

I do not think that the negative blood culture proves that there is no systemic infection.

DR. R. R. HUGGINS (closing).—Replying to Dr. Piper, I have never seen a case where there was a complaint of pain previous to confinement. This is undoubtedly a blood stream infection. The only difference between it and septicemia is that it is a milder form and is localized. These bacteria are going through the blood stream, but, as yet, we are unable to find them. The cases I report have been operated after careful study and after the exhaustion of all other methods of treatment. After a patient has been observed for 12-14 or 16 days, one should be able to calculate as to the possible outcome. It is possible, of course, that we may operate upon a patient who would recover without operation. The one point that I want to make in this paper, and apparently failed to get over, was that it was not hard to open an abdomen and look into it. In our experience, it has never shortened a patient's life, and it is not difficult to discover infected veins. If they are not infected, they should not be ligated.

A careful study of these cases will show a difference between the more serious ones, and those that are getting better for a period of days. It is not an operation for every day; it is an exceptional one, and one that should be held in abeyance and I am not especially enthusiastic about it, and am not upholding the operation in a radical way. I am merely trying to indicate that occasionally there is a case that justifies an exploratory incision and a life might be saved, otherwise lost.

DR. GEORGE GRAY WARD, NEW YORK CITY.—Will you just state how long you waited after the infection started in this series of cases?

DR. HUGGINS.—I have here a report of twelve cases. Four of these patients died and eight got better, but they were all desperately sick. They were not mild cases that I operated upon. The cases that died had gone from four to eight weeks. The ones that recovered were operated upon within eighteen days.

DR. ROBERT T. FRANK, New York City, read a paper on **Function of the Ovary**. (For original article see page 585.)

#### DISCUSSION

DR. M. A. GOLDBERGER, NEW YORK CITY (By invitation).—After the development of our technic we studied 54 specimens of blood in that number of women with regular menstrual dates. Results of these studies are as follows: Of the venous blood obtained on the first day of the menstruation, 3 cases were positive; on the second day of the menstruation, one case negative; on the third day, one case was positive. One and two days before the menstruation there were 7 cases and all were positive; 3 to 6 days before menstruation there were 9 cases, 6 were positive and 3 were negative; 11 to 15 days before the menstruation there were 11 cases, one positive and 10 negative; 16 days or more before the menses there were 13 cases, and all were negative.

In some of these cases we were able to follow our patients through one or two menstrual periods and in those instances it was particularly evident that there was a gradual increase in the hormone from the tenth day before menstruation until the first day of the menstruation; and there was a period from the second day of the menstruation to within ten days before the next expected period in which there either was none or not a sufficient quantity of hormone to be determined by our present methods.

In the cases of pregnancy we had difficulty due to faulty technic. For that reason our results are not so striking as they should be. However, with the perfection of the technic we feel that the results will be more concordant. Results of the studies in pregnancy cases are: 6 to 8 weeks pregnant, there were 9 with 4 positive; 2 to 4 months pregnant, there were 5 cases, 1 positive and 4 negative; 4 to 6 months pregnant, there were 6, 5 positive and 1 negative.

Tentatively, we feel that in all cases of pregnancy we will be able to obtain more positive results. Our later cases all gave positive results.

It is rather difficult to obtain menstrual blood, especially on the first day of flow. For this reason the number of cases is small, but in only one instance did we fail to observe a positive reaction. Of course, of menstrual blood we never obtained the large amount which could be procured from veins. In cases of menorrhagia and metrorrhagia, both in the venous and uterine bloods, we have rarely ascertained the hormone. The only exception was a young girl who was admitted for puberty bleeding, having bled for several weeks. Her menstrual blood gave a very strong positive reaction. Whether this signifies that ovulation occurs during this period of bleeding we are not yet able to state.

DR. JOSEPH BRETTEAUER, NEW YORK CITY.—I wish to congratulate Dr. Frank upon his results, and the Society upon the fact that this important work has come from among its members. Dr. Frank's warning as to the serious aspect connected with the use of certain preparations in our work, should receive our earnest attention.

DR. EMIL NOVAK, BALTIMORE, MD.—The essayist's general conclusion, that the female sex hormone is to be found not only in the follicle but also in the corpus luteum and placenta, and that these structures are therefore to be grouped together as a "gestational gland," is rather confusing to those of us who are chiefly concerned with the human aspects of the problem. It should not be forgotten that there are certain very important differences between the sexual cycle of most of the lower animals and that of the woman, and there is a good deal of evidence to indicate that in the woman the corpus luteum plays a much more important part in the cycle than it does in the lower animal. In the latter, on the other hand, the follicle may be relatively more important. There are, in the human body, many examples of synergistic actions of various ductless glands but certainly we are not justified in grouping such synergistic structures as one and the same organ.

While it is true that from a developmental standpoint the corpus luteum is simply an elaboration of the growing follicle, there seems little doubt that it acquires certain characteristics and functions which are not possessed by the follicle. Again, the endometrial changes apparently associated with follicle activity are not in any way to be compared to those which are apparently associated with the stage of full maturity of the corpus luteum. The latter are characterized, not only by an increase in the hypertrophic changes in the endometrium but by a totally new picture, that of secretory activity. If, in the human being, the mature follicle is removed, the next menstruation is apt to be skipped. If, on the other hand, the corpus luteum be removed a few days before the expected date of menstruation it may be confidently predicted that the menstrual flow will follow, usually within a few hours of the operation, apparently as a result of the withdrawal of the protective influence of the corpus luteum upon the endometrium. Again, those who have been working with the lower animals, have been able to play the follicles against the corpora lutea in such a way as to make us feel that the functions are not by any means similar.

My own reaction from all I have been able to read and observe on this subject—and I have read all of Dr. Frank's articles—is that the physiology of menstruation of women is somewhat different from that predicted by Dr. Frank. I believe that the follicular secretion produces the earlier and more gradual hypertrophic changes in the endometrium (interval phase) but that a few days before the next flow the corpus luteum steps in and produces an entirely new picture, with marked hypertrophic changes and definite secretory changes, producing the well-known premenstrual or pregravid phase. The highest point of development in the endometrium is just before the onset of the flow, at which time something happens to check the

further development of the corpus luteum, and this something is a factor of remarkable clock-like periodicity. It seems to me that the only thing we can think of as causing this four weekly cycle is the death of the ovum, which had been given off about two weeks previously and which has a definite life span of probably two weeks. If not fertilized before it reaches the end of its trajectory, the further development of the corpus luteum is checked and all of the elaborate preparations the endometrium has made for the reception of the possibly impregnated ovum are rendered useless. It therefore dismantles itself and it is this breaking down or catabolic process, attended with bleeding, which we call menstruation.

DR. FRANK W. LYNCH, SAN FRANCISCO, CAL.—I should like to ask Dr. Frank if he can give any observations he has made with the follicle secretions of cystic ovaries, the ones we want to believe are atresic follicles; and also if he has done any work with the corpus luteum after the period of its regression.

DR. CAREY CULBERTSON, CHICAGO, ILL.—As a result of some histologic work we have been doing for three years or more, we have been able to determine one of the products from the gland cells. We have definitely shown the glycogen, but this gland produces something else in addition to the glycogen, the nature of which we have been unable to determine. Dr. Frank's report this morning would show that this sex hormone, whatever it is, is produced and is thrown off with the menstrual discharge. This tends to put a slightly different conception upon menstruation. The old idea, the prescientific idea of menstruation, was that it was a secretion; that it was the excretion from the body of some substance which it was good for the individual to get rid of, and it may be that we will have to come back to that conception of what the menstrual flow means.

I should like to ask this: In some women we have two types of menstruation, one that is better than the other, usually alternately. We have not been able to demonstrate in every instance a follicle and that brings up the old question whether menstruation depends upon a follicle in every instance or not? It has occurred to me that this work of Dr. Frank's might help to solve that problem.

DR. JOSEPH L. BAER, CHICAGO, ILL.—Those of us familiar with Oscar Frankl's investigations are acquainted with his explanation that the ovum after discharge and while passing through the fallopian tube derives its sustenance by contact with the lining of the fallopian tube and at the same time gives off into the fallopian tube, and so into the circulation, a something which maintains the life of the corpus luteum. If then the ovum disintegrates, that activating substance from the ovum no longer reaches the corpus luteum; the corpus luteum itself disintegrates, the accumulated trypsin in the distended glands of the endometrium is released, the trypsin frees the capillary blood and so menstruation occurs.

I should like to ask the Doctor, if we are to consider this female sex hormone as specific for the female, even in fetal life? How does he explain the fact that in the newborn breast engorgement occurs so preponderatingly in male children?

DR. FRANK, (closing).—Our results with the female sex hormone in pregnancy were unsatisfactory at the start because we didn't know that it is present in the blood in minor concentration in gestation before menstruation. Since we ascertained that fact we no longer get negative results.

Our work has been purely objective. The results are extremely concordant, and have enabled me to elaborate what I hope will prove a sound theory, yet I do not propose to make application of results to the human being until I know much more than I do at the present time, although we are able to distinguish two types of menorrhagia and of metrorrhagia.

Dr. Novak's interesting remarks about menstruation I am glad to hear. I do not expect that our theory will be accepted at once and without opposition. We propose to work it out in much greater detail.

In my paper I have made reference to Papanicolaou's recent work in which he found an inhibitory substance in the corpus luteum. I have had personal communication with him and although I have not convinced him as yet, I feel that we are speaking of the same substance used in different amount. His substance works by suppressing ovulation, in other words by inhibiting the maturation of the follicle. Dr. Herbert Evans of Berkeley, California, has another substance which he obtains from the pituitary gland which suppresses ovulation, by an entirely different mechanism. As a result of injecting his substance there is a tremendous increase of the theca lutein portion of the ovary. So perhaps there are two substances at work.

I am trying to present a large subject in a short outline and, therefore, am unable to deal with all its phases. By no means do I try to minimize the importance of the other glands of internal secretion. In a paper in 1917 I reported that I obtained the same response to the female sex hormone after removing the thyroid, adrenals and pancreas as when these glands were present. I have never succeeded in removing the pituitary on account of the difficult operative procedure.

I would like to call Dr. Novak's attention to a fact that I know he is familiar with. I am willing to admit that I am unable to distinguish by histologic criteria the exact point at which a pregravid and an early gravidity reaction can be differentiated; that is, whether it is going to be a fertile or non-fertile cycle. This lends evidence to my contention that these cycles at their beginning are identical.

A striking fact came to our attention the other day. A woman offered her blood for transfusion—this was two days before the expected regular menses—500 c.c. were abstracted but her menstruation failed to appear. We interpreted the postponement as due to the fact that too much female sex hormone was removed with the blood and that therefore, although the pelvic changes were well underway, the acme was not reached because of this abstraction.

Now as to my claim that the substance derived from corpus luteum and from the follicle and from the placenta are identical: that is based mainly on matters that I was not able to bring before you on account of the shortness of time. My collaborator, Dr. R. G. Gustavson, an expert chemist, has tried to purify the substance and in the purest form whether derived from follicle, corpus luteum or placenta it is indistinguishable. Pharmacologically, by three different tests, on the rabbit it produced the growth of the uterus which I am showing in the figures passed around, in the rat it changed the vaginal spread, and in the previously treated isolated rat uterus it affected the contraction rate identically no matter from where derived. I do not hesitate, therefore, as all pharmacologic and chemical tests are concordant, to state that the female sex hormone is secreted by these three glands. I shall be perfectly willing to change my mind if sufficient evidence to the contrary is offered.

As to cystic ovaries, we have had only three cases where we could try them out and with the small amount of follicle fluid at our disposal for such a test, we nevertheless believe that some of these cystic ovaries are functionless. Dr. Lynch inquired concerning the potency of the corpus luteum. I purposely left out controversial matters. The chief opponents of the view that the corpus luteum does contain the hormone have finally conceded that in the human being they find it present. I don't believe that any anatomist or physiologist will seriously consider the theory of those who believe that a primate differs from the lower vertebrates in regard to its corpus luteum. The difference in potency of the corpus luteum was a matter that bothered us for a long time, but we finally found that the follicle contains the sex hormone in great concentration. The early corpus luteum when first studied contained none that we could demonstrate. The corpus luteum contains very little in the flourishing state, but as it begins to involute it again contains more of the female sex hormone. I had devised the following explanation

even before I found the hormone in the circulating blood. As soon as follicle-rupture occurs the capillaries enter the follicle cavity; the hormone then at once enters the blood stream as rapidly as it is secreted and it appears then in great concentration in the circulating blood. As soon as the blood vessels begin to involute, the hormone begins to collect in the corpus luteum and that is the reason why different corpus luteum material has varied so much in its contents of female sex hormone. In the early stage it gets into the blood where we have demonstrated it. In the later stage it again collects in the gland for a short period. I am not ready yet to enter fully into the mechanism of excretion of the hormone through the uterine mucous membrane, and as I want to deal only with facts for which I have a distinct authentication, I cannot answer that question, nor why the mucosa exfoliates.

As to the ovary secreting an activating substance, I can only tell you that we cannot find the female sex hormone in the fetal tissues or the fluid surrounding the fetus. As to the theory of trypsin acting on the tissues, I think erepsin was mistaken for trypsin (the former being present in every tissue of the body) as I showed some years ago and published in the Transactions of this Society.

I am glad the question about the newborn breast was brought up. The male fetus shows it as well as the female. Among the photographs and drawings that I passed around were the breasts of a rabbit, from the same rabbit, the one being the immature breast, the other the breast taken in the middle of the cycle, and these same breast changes are shown. A tremendous increase in size can be brought on at will in the experimental animal. The same thing takes place in the human fetus. The breast is activated by the sex hormone given out by the placenta and, just as in the adult, when this hormonal influence is withdrawn you get secretion from this structure. As to the specificity of the female sex hormone I will simply reiterate that by chemical identification and numerous pharmacologic tests no difference can be demonstrated between the hormone obtained from follicle, corpus luteum and placenta and that no convincing evidence that substances derived from other sources, produce the specific reactions has been forthcoming.

DR. B. Z. CASHMAN, Pittsburgh, Pa., (by invitation) read a paper on **The Advantage of Cauterizing the Cervix in Hysterectomy.** (For original article see page 591.)

#### DISCUSSION

DR. S. A. CHALFANT, PITTSBURGH, PA.—We have been using this method for some little time, possibly not quite so long as Dr. Cashman, and have found it very satisfactory so far. The thorough cauterization of the cervix has done away with the annoying leucorrhea following a subtotal hysterectomy.

As to the liability of carcinoma in these cases, I think time only will tell. We have not seen any as yet, although we have seen two cases in ordinary subtotal hysterectomy.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—Since presenting a paper some years ago on the incidence of cancer in the stump and the advantages of a panhysterectomy, we have been employing the method of coning out the cervix in order to compare our results. We do a rather more radical procedure than the Doctor has suggested because of the feeling that this cauterization of the cervix mucosa will not protect the woman from cancer. Notwithstanding the fact that most authorities say that erosion is a precursor, we believe there are portio cancers that are not preceded by erosion. Consequently we have adopted practically what Byrne did

in his procedure. We make a circular cauterization of the cervix, destroying the entire mucosa, and cone out a large part of the portio. The inversion of the vaginal mucosa is very perfect and the leucorrhea has been cured absolutely in every single case.

Our histologic studies of the effect of the cautery on the cervical tissues shows that there is an extension of the effect of heat far beyond the area of cauterization, some 2 or 3 mm. beyond the separation of the slough. If we are to believe that it is always necessary for an erosion to precede the development of a cancer then we certainly have in the cautery a substitute for complete hysterectomy.

DR. ALFRED B. SPALDING, SAN FRANCISCO, CAL.—A great deal has been said about the advantages of panhysterectomy over supravaginal hysterectomy, and as to the danger of cancer developing in the cervical stump. The reason that for some years now I invariably perform panhysterectomy was not entirely this danger but the bad effect on the internal secretions caused by leaving an infected cervix. I have for some time been interested in the effect of focal infections in the pelvis on internal secretions. I believe, that the bad late results in regard to the post-menopausal changes after hysterectomy often come from leaving infected areas and that when the cervix is removed, the postoperative results are better in regard to the menopausal symptoms. I also believe that Bartholin's glands should be removed and Skene's glands cauterized at the same time. So many women who have a hysterectomy carry these focal infections. Perhaps cauterization will remove some of the infection, but it can be better removed by operation and with less danger if the operator gets in the habit of taking the uterus out completely.

DR. HARVEY B. MATTHEWS, BROOKLYN, N. Y.—In reference to the extension of the heat: the heat from the electric cautery extends 3 to 5 mm. Corbus has shown that the heat from the cautery will kill most of the bacteria, particularly the gonococci, at that distance. So, in spite of what Dr. Spalding says, the heat from the cautery does destroy considerable infection from below. If you remove the cervix down to and beyond where the cautery has extended from below, it seems that you will eliminate sufficient infection not to be troubled with exudates afterwards. In certain extensive chronic pelvic inflammations what Dr. Spalding says may be perfectly true, that complete hysterectomy may be better, but certainly the ordinary endocervicitis with its consequent cellulitis can be treated by cauterization which is a time-saver and is just as complete.

DR. JAMES R. GOODALL, MONTREAL, CAN.—I would like to ask whether Dr. Cashman and the others who have used this method have had to open the cervical canal to evacuate secretions retained owing to cicatricial contractions?

DR. JOHN A. MC GLINN, PHILADELPHIA, PA.—The basic proposition of this question is that undoubtedly the patient would be very much better off after operation if she did not have her cervix. There enters then the question of the risk of the removal of the cervix in comparison with the danger of the cervix left behind. Complete removal of the cervix does not protect the patient against cancer because she might develop cancer in the vaginal vault even after excision of the cervix. The cautery undoubtedly may prevent the great majority of cases of endocervicitis if done in the way that has been advocated today, and will probably cure the majority of cases of gonorrhea, but gonorrhea is not always cured by this method, neither is it always cured by the ordinary cauterization methods of Dickinson. In the presence of marked inflammatory disease the complete hysterectomy is not applicable in the majority of cases. There is too much risk for what you will attain. There is no doubt that cancer will develop in many of these cervixes, but I question whether it will kill more patients than saved in operation when a cervical stump is left behind.

DR. B. Z. CASHMAN (closing).—It requires so little time to cauterize the cervix; there is no hemorrhage; and it adds but little to the operation.

In regard to the remark that carcinoma of the cervix does not depend upon erosion: we see many cases of profuse discharge coming from a normal looking cervix but whether there is an erosion or not, cervicitis is present.

Dr. McGlinn says that even with extensive cauterization he doesn't cure gonorrhea. I believe that is because there are other structures involved. If he burns them as deeply as I do and has destroyed the glands, the cervicitis is cured. Where there is no evident involvement we don't make it a routine to remove Bartholin's glands. We have had no cases where we have had to open the cervix for retained secretions, following hysterectomy.

If we are going to remove the uterus we can go to the limit, so we make sure that we cauterize deeply in order to get these glands. There are some cases where there are cysts at the periphery, and then we feel that amputation with the cautery is better than mere cauterization of the cervix.

The following papers were read in a SYMPOSIUM ON MISPLACED ENDOMETRIAL TISSUE.

**A Contribution to the Study of Endometriosis**, by Dr. Carl Henry Davis, and Dr. Roland S. Cron, Milwaukee, Wis. (See page 526.)

**The Significance of Uterine Mucosa in the Fallopian Tube, with a Discussion of the Origin of Aberrant Endometrium**, by Dr. Emil Novak, Baltimore, Md. (See page 484.)

**Endometriosis of the Sac of a Right Inguinal Hernia—Associated with a Pelvic Peritoneal Endometriosis and an Endometrial Cyst of the Ovary**, by Dr. John A. Sampson, Albany, N. Y. (See page 459.)

#### DISCUSSION

DR. JAMES R. GOODALL, MONTREAL, CANADA.—Endometriosis is a clinical entity which has been established beyond any possibility of doubt. The two questions which do arise are, first of all the origin of this tissue, and Dr. Novak has put that matter very clearly; and the second question which has not been touched upon is the end-results of these cases.

As to the origin, I don't think it will ever be possible by the study of the human anatomy to say that the overflow from the uterus and the tubes is not the cause, or that it is the cause, or that all of the tissues of this nature arise from preexisting endometrial tissue in the ovary. I do think, however, that a solution of this problem may come from a study of comparative physiology in lower animals where there is no menstrual flow and yet where by careful observation we may be able to determine in the lower animals a cause of endometriosis. That, if established, would, I think, clear up the matter once for all. Personally, after an examination of some 22,000 sections of the ovary, I feel more inclined to attribute the origin of this disease to ectopic embryonal tissue of an endometrial nature in the ovary, because after careful examination I have come to the conclusion that in about 50 per cent of human ovaries we find types of tissues that more or less closely resemble endometrial tissue. I think the great virtue of Dr. Novak's work is establishment of the fact that unless the superficial layers of this ectopic tissue are markedly developed, the stimulus supplied by the hormone does not lead to menstrual blood in this ectopic tissue. In many of my sections where I found



endometrial tissue in the ovary without any involvement in the peritoneum, some were undergoing hemorrhagic states whilst others were quiescent. There is often a direct communication, as Dr. Novak as shown, between endometrial tissue on the surface of the ovary and deep seated similar tissue, the two being connected sometimes by endometrial interstitial tissue only, at other times by interstitial and glandular structures. We find abnormal glandular tissues in the ovary in about 90 per cent of human organs. In comparative human anatomy we find that there is a great difference in different species in the amount of abnormal rests in the ovaries. In one series of animals, e.g., the pig, fetal rests are extremely uncommon, whereas in the sheep the rests are so common as to be almost as numerous as the normal graffian follicles. It is not surprising that we find so much of this ectopic tissue in the human when we consider the embryology of the ovary. I have said that the human ovary is a hodgepodge of ectopic tissue, and so it is. When we realize that the general epithelium dips down through the ovary to communicate with the central body and from there passes on to the paraovarian ducts, and that this becomes a permanent structure in the male but undergoes atrophy in the female, we realize that this atrophy may be complete or incomplete, and that is the origin of all ectopic tissue in ovarian structures. Abnormal tissues in the ovary are the direct result of lack of destruction and lack of total absorption.

It is strange that in the question of endometriosis the pathologist has come so little to our assistance. I don't think it is possible, although Dr. Novak's paper is very convincing, to come to any other conclusion than that a large number of cases are really primarily ovarian in origin and that the grafts are going down the tube in the ordinary course of the current. We cannot deny that it may occur in the opposite direction in a large number of cases. I have seen blood dropping from the tubes when I opened the peritoneal cavity, but unfortunately in both of the cases I had curetted and dilated the cervix prior to opening the abdomen. I think if inflation of the tube may be a factor in driving tissue through the tube into the peritoneal cavity, the use of dilators must be a much stronger factor in driving tissue through the tubes, if such an avenue is opened. This then takes away any value that my observation may have had in demonstrating blood dripping from the tubes. I have not found blood issuing from the fimbriated end of the tube in a case where I had not previously dilated.

DR. N. SPROAT HEANEY, CHICAGO, ILL.—Since the last meeting I have had six cases of endometriosis which I think are of considerable interest. There were four cases where the abdominal wall was involved, three of them following laparotomy. One was operated upon while the patient was menstruating. There was an adenoma of the umbilicus which menstruated and that patient had not had a previous operation. Associated with the adenoma of the umbilicus existed an adenoma of the rectovaginal septum, but at operation there was no connection that I could see between these two adenomas. In one case, in early pregnancy the adenoma of the rectovaginal septum looked like a carcinoma, and there were four perforations in the vaginal vault out of which polypi hung. This case I operated through the vagina and when the nodule was excised polyps were hanging into the culdesac from similar openings on the culdesac side and one of these openings was continuous from the vagina to the peritoneal cavity. A probe introduced went on through.

Also one of the two cases of adenoma of the bladder, reported by Dr. Keene at the last meeting, has come under my observation. About 18 months ago she came to Dr. Keene for chocolate cysts and adenomyoma of the uterus. A diagnosis of adenoma of the bladder also was made previous to operation, the cystoscope showing the bluedome cyst in the bladder. Dr. Keene did a supravaginal hysterectomy with removal of both tubes and ovaries. Subsequently was observed disappearance of the adenomatous tissue from the bladder. Later on account of an

intractable cystitis she came to Dr. Kretschmer at the Presbyterian Hospital. Through the cystoscope he removed a bit of tissue for examination and it showed three typical endometrial glands. I operated upon her by the abdominal route hoping to resect the bladder. No ovarian tissue had been left by Dr. Keene. I had thought probably some ovarian tissue had escaped his attention and this accounted for the continued life of the endometrioma of the bladder. Upon opening the bladder it was found that the involvement was too extensive for removal. The bladder was involved for two-thirds of its circumference and clear down to the urethra. The abdomen was closed, a retention catheter inserted. A week or ten days later I produced a vesicovaginal fistula to relieve her of the pain. At that time I removed some pieces of infiltrated bladder wall but did not examine the sections until today with Dr. Sampson. Several slides failed to show any endometrial tissue. The patient now has a carcinoma of the bladder, of the transitional type. That there is any connection between the previous endometrioma and the present carcinoma of the bladder might be questioned.

All conservative abdominal operations are preceded by a dilatation and curettage. This probably accounts for the fact that blood dripping from the tubal opening with me is not at all an uncommon finding. We also use Hegar's dilators.

Dr. Novak has shown here within the tubes perfectly formed oval glands and a large amount of stroma, perfectly typical of normal endometrium in the uterus. I have never seen such normal endometrium in ovarian transplants or in chocolate cysts. Usually it is somewhat irregular and is generally quite scanty. The only time I have seen such normal appearance in ectopic endometrium was in the case where the polyps were hanging in the vagina and the culdesac.

DR. WILLIAM C. DANFORTH, EVANSTON, ILLINOIS.—I have on at least one occasion in operating during the menstrual period seen a small amount of blood come from the tube. Again, chocolate cysts seem always to be found in association with patent tubes. It therefore has been easier for me to accept the transplantation theory than the metaplastic one.

If the former is correct it certainly has a practical bearing on the tubal insufflation test. It would seem to place the preferable time for insufflation between the periods rather than immediately afterward, as Dr. Rubin recently suggested. I should like to know Dr. Sampson's attitude toward the insufflation test.

I have seen since the last meeting of this Society one more endometrioma in the abdominal scar seven years after a classical cesarean section. About a year after this operation a mass appeared in the scar which became painful and swollen at the menstrual period. For about one year previous to the time at which I first saw her she had had some discharge of blood from the growth at each period. There were several small bluedomed cysts upon it. The mass was removed and sections showed a considerable number of very typical nests of endometrial tissue.

DR. ROBERT T. FRANK, NEW YORK CITY.—Two very lucid and eloquent speakers have just expressed diametrically different views on the same scientific subject. I want to state that I still have an open mind because it is very possible that the Recklinghausen-Wolfian theory will hold good in certain cases; that Cullen's uterine origin from the adenomyoma in others may be correct; and that the source of origin advanced by Dr. Goodall, Dr. Novak and Dr. Sampson in certain cases may be correct, and I don't know whether we shall ever be able to arrive at an all inclusive etiology.

In 1916, at the meeting of the American Society for Cancer Research, I demonstrated the fact that if endometrial mush, made from the rabbit's uterus, is injected in the breast of the same animal a stimulation of these dissociated cells by the injection of the female sex hormone will lead to the reconstitution of endometrial structures; much as Jacobson produced in the pelvis by means of uterine

grafts. This fact would, however, not militate against the other theory, for if tissue derived from the ovaries has all the qualities of an indifferent tissue which can as it grows develop in various directions, similar results might be produced.

DR. OTTO SCHWARZ, ST. LOUIS, MO. (By invitation).—In the study of endometrial tissue in the ovary the implantation theory has impressed me for two reasons. In the first place, the surface of the ovary, which is in close proximity to the fimbriated end of the tube, is most frequently the site of the lesion; and secondly, in its earliest stages in the ovary the lesion is always very superficially placed.

There is no question that the pictures shown by Dr. Novak illustrate definite pieces of endometrium within the lumen of the tube. I believe, however, that in discussing the transit of endometrial tissue from the uterus to the peritoneal cavity one would expect to have very much smaller particles than these pictures show. I therefore believe that if this transit does take place, smaller particles get through, reach the ovary, are cultivated there, and are subsequently disseminated into the peritoneal cavity. This tissue could readily lodge on the fimbriated end of the tube and be carried within the lumen as Dr. Novak has illustrated.

I have studied a case of hematosalpinx in which the tubal mucosa simulated the endometrium, and in one place there was well developed endometrial stroma. I am under the impression that this has been rarely observed. It would seem to me that if the theory that these lesions develop primarily as a result of metaplasia of the celomic epithelium, the lesion could be expected more frequently in the tubal mucosa, because in its early development it is more closely related to the endometrium.

I have been able to demonstrate the ease with which endometrial tissue can be implanted. In an experimental study dealing with the cesarean scar in the uterus of pregnant guinea pigs, I frequently observed endometrial tissue along the line of incision in the uterus, as well as frequent implants on the peritoneal surface of this organ. These were all accidental implants but quite conspicuous.

DR. CAREY CULBERTSON, CHICAGO, ILL.—The patient of mine to whom Dr. Davis referred was complaining of sterility and a mild pelvic pain. She was given a test of tubal patency at the time and a month later. The test being positive, the patient returned later under my observation, complaining of some dysmenorrhea and mild pain in the pelvis. So far as we have been able to find out, the symptoms subsequent to insufflation test were not worse than those of which she had previously complained. At operation, performed after two weeks of observation, I found a chocolate cyst of the right ovary with an exceptionally redundant hyperplasia, endometrial in type, covering the entire floor of the pouch of Douglas, involving the anterior rectal wall and the prolapsed left tube was immersed in it. Pathologic examination showed in the chocolate cyst perfect endometrial tissue containing blood and stroma, premenstrual or practically in the active menstrual stage. This case may be accepted as possibly representing the effect of a tubal insufflation. On the other hand, the symptoms were not more marked before than after the test.

DR. ARTHUR H. CURTIS, CHICAGO, ILL.—At Dr. Sampson's suggestion, about a year and a half ago we began to observe the frequency of the dripping of menstrual blood from the open ends of the fallopian tubes. Since this time we have been operating, whenever possible, at the time of menstruation. Menstrual blood has been observed coming from the tubes in three patients. (Another typical case of retrograde menstruation was observed ten days after this discussion.)

The more one looks for these endometriosis cases, the more of them one observes. Dr. Watkins and I watched for chocolate cysts and endometrial implants, and over a period of two years observed only three cases. During the last six months I have encountered approximately fifteen patients with endometrial implants.

It is worthy of note, in consideration of the possible connection between retrograde menstruation and implantation, that in nearly all of the patients seen within the last six months there has been a retrodisplacement of the uterus; in every instance the fimbriated ends of the tubes have been patent.

DR. JAMES R. GOODALL, MONTREAL, CANADA.—I have had a large number of cases of endometriosis lately, and two of chocolate cysts. In two cases one ovary was badly necrotic, the other had a very minute excrescence on its surface. I took out the diseased one and left the other and told relatives in both instances that I had done a partial operation and might have to reopen the abdomen later for complete operation. Was I justified, or does complete isolation produce retrograde changes in this type of tissue? I would like to have an expression of opinion on that subject.

DR. CARL HENRY DAVIS (closing).—The papers today show that the etiology of this interesting condition is still a subject for investigation. We believe with Dr. Sampson that small bits of endometrial tissue may be forced through the isthmus of the tube and continue to live and grow. Until this will have been disproved we would urge great care in the performance of tubal inflation, and dilatation, and curettage.

Dr. Novak questions the viability of the endometrial tissue which is shed at the time of menstruation. It is our belief that many of the cells are living and able to reproduce themselves in proper media. We are undertaking experiments which we believe will enable us to answer this question.

DR. EMIL NOVAK (closing).—I am glad to note that Dr. Goodall also lays much stress upon abnormalities of development as possible factors in the explanation of endometriosis.

In reply to Dr. Heaney, I may say that the endometrium found in the tubes of my cases was not of the menstruating type. In other words, the factor of menstruation is probably not always concerned in the production of such wandering bits of tissue. My first case, for example, shows how readily a surface bit of endometrium on the ovary could break off by the slightest trauma, such as bimanual examination or intestinal peristalsis. It would then readily find its way into the wide open mouth of the tube. It is possible that these bits of tissue migrating through the tube may retain their viability or even undergo a certain amount of development from the tubal walls, although we cannot of course do more than speculate on this point at present. Dr. Heaney's statement that he had never observed such typical looking and well preserved endometrium in ovarian "implants" or in chocolate cysts was rather surprising, in view of the perfectly typical endometrium shown in many of Dr. Sampson's illustrations and in some of Dr. Davis' slides as well. We likewise have frequently observed in the ovary endometrial tissue which could not be distinguished from that on the uterine surface.

I agree with Dr. Danforth that Sampson's theory offers the shortest cut to the explanation of aberrant endometrial tissue, but, as I have tried to show, there are many objections to its correctness, especially as regards the occurrence and importance of tubal regurgitation of endometrium from the uterus. Dr. Sampson's case of endometriosis in a hernial sac is of interest from this standpoint. If a particle of viable endometrium did actually escape from the tube, would it sink like a stone to the bottom of a hernial sac, or would it adhere to and perhaps grow on the first peritoneum with which it came into contact? Even the influence of menstrual blood is questionable, as would appear from the case of hernia which I reported in my paper. In this case, among other things, the hernia was of the ventral type, and situated just below the navel, so that menstrual blood could scarcely have gotten into this sac. And yet, endometrial tissue was present

in abundance. Furthermore, I have seen endometrium in the vulva, evidently arising in the remains of the processus vaginalis, which had no doubt long since been shut off from the peritoneal cavity. Four such cases have recently been reported by Palmer. In such instances the theory of Sampson falls short, but the celomic theory offers a very plausible explanation.

Dr. Sampson's theory would be greatly strengthened if he could demonstrate two things, (1) the capacity of the degenerated endometrium, given off at menstruation to grow in tissue culture; (2) the capacity of such endometrium to grow on the peritoneum or ovary of the human being or perhaps even of one of the lower animals. Both of these proofs are lacking, and, because of innate difficulties, I am inclined to believe it will be difficult to prove either point experimentally.

My paper may have seemed more destructive than constructive, to which charge I plead guilty. While I do not feel that Dr. Sampson has demonstrated the correctness of his theory, I do not arbitrarily urge the correctness of the explanation which I have offered, and, indeed, there are many points which are far from clear on the basis of any explanation which has yet been suggested.

DR. JOHN A. SAMPSON (closing).—In my early studies of pelvic peritoneal endometriosis I believed that the endometrial tissue in these lesions arose from the implantation of bits of this tissue derived solely from the perforation of an endometrial cyst of the ovary and from the menstrual reaction of endometrial tissue on the surface of that organ. At that time I thought that the endometrial tissue in the ovary probably developed solely from its surface epithelial as described by Russell. Later I found that pelvic peritoneal endometriosis occurred without any demonstrable endometrial tissue in the ovary and naturally looked for another avenue by which bits of the uterine mucosa might gain access to the peritoneal cavity. I carefully examined the fallopian tubes of patients operated upon during the menstrual period and occasionally found blood escaping through their fimbriated ends. I thought, and still do think, that bits of endometrial tissue in this blood become implanted not only upon the peritoneum but also on the ovaries. While I have been very enthusiastic over the implantation of endometrial tissue from this source at no time have I been able to convince myself that it was the sole cause of endometrial tissue in the ovaries. The ovary differs from the pelvic peritoneum in that a variety of epithelial growths arise in it and it is natural to assume that potential müllerian tissue at times might be present.

I have frequently observed blood escaping through the fimbriated ends of the tubes after a preliminary curettage. I have found bits of the uterine mucosa in the lumen of sections of these tubes showing that unless it was there beforehand it readily passed through the interstitial portion of the tube and also, under certain circumstances, it takes but a very short time for blood containing bits of the uterine mucosa set free by curettage to escape from the uterine cavity out through the tubes into the peritoneal cavity.

I have found fragments of cancer lying free in the lumen of the tubes of patients with peritoneal carcinosis associated with a primary ovarian carcinoma. I believed that these fragments were drawn into the tube as described by Dr. Novak. While I have appreciated that fragments of endometrial tissue were set free into the peritoneal cavity through the perforation of an endometrial cyst of the ovary, and from the menstruation of endometrial tissue on the surface of that organ, it had not occurred to me that bits of this tissue also might be drawn into the lumen of the tube until Dr. Novak called my attention to it. I believe that it does occur. It adds interest to the problem and I had not studied my specimens from this standpoint. I am taking the liberty to add these notes to the discussion after reviewing my material on my return from the meeting.

In four instances in which blood was observed escaping from the tubes of patients operated upon during their menstrual period it was collected in a spoon by stripping the tubes from the uterus toward the fimbriated end. The blood was spread on slides, dried, fixed and stained by various methods. The method which was found to be the most satisfactory by Dr. L. A. Sutton who is associated with me, was to fix the slides in Zenker's solution and stain with hemotoxylin and eosin. Epithelium-like cells were found in these preparations and in some of them fragments of tissue resembling the stroma of the uterine mucosa. There are certain objections to the method. One is that the trauma of stripping the tubes may dislodge some of the tubal epithelium and the other is the difficulty we experienced in identifying the cells and tissue in these preparations. In none of these four cases was a peritoneal endometriosis present or any evident endometrial tissue on the surface of the ovaries. In four other cases one or both tubes were removed with the uterus. In the first case a peritoneal endometriosis was present and blood was observed escaping from both tubes on exposing the pelvic organs. The uterus, one tube and ovary were removed. Unfortunately, the fimbriated end of the tube was not ligated and most of the blood escaped from it during the manipulation during operation. Epithelium and tissue resembling endometrial stroma was found in the lumen of the tube and from the nature of the peritoneal lesions and that in the ovary I do not believe it could have been derived from these.

Case No. 2, the patient aged forty-four gave a history of very profuse menstruation and a previous curettage, with only temporary relief. The uterus was found to be irregularly enlarged and retroflexed. On exposing the pelvic organs at operation blood was observed escaping from both tubes. Two small pigmented blebs were present on the under surface of the left ovary and blood was not observed escaping from these. The fimbriated ends of both tubes were ligated. The uterus, left tube and ovary, and right tube were removed. This case was reported by me in a previous article (*Surg., Gyn. and Obst.*, March, 1924, p. 287). The two lantern slides shown by Dr. Novak were made from illustrations of this case in that article. Strips of epithelium were found in the lumen of the tube, one gland and also fragments of endometrial stroma, identical in their structure with those present in the mucosa of the uterus from which a large amount of tissue had been cast off by the menstrual reaction. The ovarian lesion consisted of two small cystic cavities lined by epithelium of endometrial type with very little stroma beneath it and no glands. In places a small amount of the epithelial lining had been cast off by an apparent menstrual reaction but not enough to account for that present in the tube nor did it resemble it as closely as did that in the uterus. I believe that the greater portion or all of the endometrial tissue in the tube must have come from the uterine cavity.

Case No. 3, the patient aged 49 gave a history of prolonged profuse menstruation. The uterus was enlarged due to a myoma. On exposing the pelvic organs at operation blood was observed escaping from both tubes. The fimbriated ends of both tubes were ligated. The left ovary was adherent by its lateral surface to the posterior surface of the uterus due to endometrial tissue on the surface of that organ. A small "patch" of endometrial tissue was present on the posterior surface of the uterus mesial to the left ovary. The uterus, both tubes and ovaries were removed. Small bits of endometrial tissue were found in sections of the tubes which were identical in their structure with fragments of the uterine mucosa present in sections of blood obtained from the uterine cavity. I cannot exclude the possibility that the bits of endometrial tissue in the tube in this case were not drawn into the tube from the endometrial tissue on the posterior surface of the uterus but from observations made at the operation it was evident that the blood in the tubes was coming from the uterine cavity.

Case No. 4, the patient gave a history of prolonged profuse menstruation due to a submucous myoma. On exposing the pelvic organs at operation blood was observed

escaping from both tubes. The fimbriated end of the left tube was ligated and the left tube and ovary and uterus were removed. A clump of epithelium-like cells was found in the lumen of the tube but no endometrial stroma. A mitotic figure was present in one of the cells. I was unable to find any mitotic figures in epithelial cells in the blood obtained from the uterine cavity.

There is no doubt in my mind that regurgitation of menstrual blood from the uterine cavity through the tubes does occur. I have seen blood dripping from the tube, and on squeezing the uterus have forced more out. Whether or not this causes the lesions of peritoneal endometriosis remains to be seen.

I wish to thank Dr. Novak for the friendly way in which he has attacked this subject. For the sake of the advancement of our knowledge of this subject I am glad he has taken the opposite side.

None of my patients had had a previous insufflation of the tube. I can readily see that if there is anything in the implantation theory that insufflation of the tube, if done at the wrong time, would contribute to the lesions.

Dr. Goodall's question refers, I think, to one of the most difficult problems we have in connection with this subject, that is, how to treat our patients where conservative surgery is desired. I firmly believe that removal of the ovaries will have the same effect on ectopic endometrial tissue as it does on the mucosa lining of the uterine cavity. I do think it is justifiable to do conservative surgery in women who are anxious to have children. Eight of my patients have become pregnant after conservative surgery. Usually the lesion is of slow growth and frequently does not give rise to any symptoms. If the patient is having disturbances from it and we do conservative surgery, it should be done with the understanding that we may have to resort to radical means later.

DR. ROBERT T. FRANK, NEW YORK CITY.—I have two parallel cases on which I would like to have some advice. In one I did an operation and cleared out the pelvis except the retrovaginal septum. I took out both ovaries, the patient recovered and has no pain. In another case, I did not open the abdomen but was sure the condition was present because it showed itself in polyposis of the vaginal vault. In this instance I thought the technical difficulties were so great that I used radium and x-ray. Atrophy occurred but the patient is still suffering from a great amount of pain. I wondered if Dr. Sampson had any method of treatment to offer for this condition?

DR. JOHN A. SAMPSON, ALBANY, N. Y.—I have no treatment to offer in these conditions. I have had cases very similar to the first one of Dr. Frank in which I have left behind a large amount of endometrial tissue in the pelvis after removing the uterus and both ovaries. In one instance marked obstruction of the sigmoid was present and I made a temporary colostomy. I found afterward that the endometrial tissue had cleared up to a great extent.

As to the influence of radium and x-ray, I took this up a year ago with Dr. Curtis F. Burnam and he informed me that radium would have no effect on misplaced endometrial tissue except as it would be influenced by the cessation of the function of the ovaries.

DR. EMIL NOVAK, BALTIMORE, MD.—My impression is that removal of the ovaries will ordinarily check further development of the endometrium. That, at any rate, has been my experience in a number of cases, and it is exactly what we should expect from our knowledge of the normal subservience of the endometrium to ovarian function.

DR. ROBERT T. FRANK, NEW YORK CITY.—The patient referred to has not menstruated. I am trying to contrast the two cases. Her pain which has been men-

tioned before is still present. The important thing is to determine whether roentgen castration can replace the technically difficult as well as dangerous complete operation of hysterectomy.

DR. EMIL NOVAK, BALTIMORE, MD.—I believe that radium will, through its action on the ovaries, ordinarily check further growth of endometrial tissue, but that it will have no good effect and may actually do harm in many cases, where there has been an extensive reaction produced by the growth of endometrium and where extensive adhesions are present.

DR. JOHN A. SAMPSON, ALBANY, N. Y.—You cannot tell what reaction radium might have on the other lesions. I would rather remove the ovary in those cases than use radium.

DR. N. SPROAT HEANEY, CHICAGO, ILL.—Dr. Goodall asks a question with which I have been confronted a number of times. I have had a few cases where the posterior surface of the uterus was as velvety as the lining of the uterus would be. Endometrial tissue was covering it up and making a velvety membrane, yet the patient was a young woman. Two or three very small millet seed sized implants might be found in the tube and in the round ligament, and these I treated by destroying those that were very fine with the cautery, then going over the back of the uterus with a flat cautery at low heat until the tissue as far as I could tell was thoroughly destroyed. I have not had a recurrence of the trouble yet, and two of those patients are pregnant. There might be difficulty, where there is a great deal of infiltration, to destroy them safely, but where they are superficial and thin it seems to me that this might be one method of destroying these endometrial grafts.

DR. WILLIAM C. DANFORTH, EVANSTON, ILL.—I had two instances of young women, twenty-three and twenty-four, in whom one ovary was taken out and the other was resected. One patient has had two successful pregnancies; the second become pregnant and aborted at the end of three months. Neither one has developed any subsequent trouble.

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*(As this issue of the Journal is given over to the Transactions of the American Gynecological Society, the usual special departments have been omitted, but their publication will be resumed in the November number.)*



## Books Received

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VEIT'S HANDBUCH DER GYNAEKOLOGIE. Dritte Auflage herausgegeben von Professor Dr. W. Stoeckel, Berlin. Zweiter Band, mit 265 Abbildungen im Text. Verlag von J. F. Bergmann, Muenchen, 1926.

L'ESPLORAZIONE DELLE VIE URINAIRE nella pratica ostetrico-ginecologica. Dott. Carlo Colombino. Con 102 figure nel testo e 5 tavole a colori. Milano, L. F. Cogliati. 1926.

CLINICA OBSTETRICA, por Dr. Guillermo Liepman. Cuarta edicion, traducida por el Dr. Victor Conill y Montobbio, Barcelona. Salvat editores, Barcelona, 1926.

MANUAL OF PROCTOLOGY, by T. Chittenden Hill, Ph.B., M.D., F.A.C.S., instructor in proctology, Harvard Graduate School of Medicine, etc. Second edition, thoroughly revised. Illustrated with 101 engravings. Lea & Febiger, Philadelphia, 1926.

CLINICAL PEDIATRICS, by John Lovett Morse, professor of pediatrics, emerit. Harvard Medical School, etc. Illustrated. Philadelphia, W. B. Saunders Company, 1926.

INTERNATIONAL CLINICS. A quarterly of illustrated clinical lectures and especially prepared original articles, etc. Volume III, thirty-sixth series, 1926. Philadelphia, J. B. Lippincott Company, 1926.

BIRTH CONTROL AND THE STATE. A PLEA AND A FORECAST. By C. P. Blacker, M.C., M.A., M.R.C.S., L.R.C.P., New York, E. P. Dutton & Company, 1926.

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## Original Communications

### STUDIES IN ANESTHESIA, ANOXEMIA, ANHYDREMIA AND ECLAMPSIA, WITH CERTAIN DEDUCTIONS CONCERNING THE TREATMENT OF ECLAMPSIA

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FROM a consideration of the blood changes in eclampsia, as recently reported by Stander and Radelet,<sup>1</sup> it became apparent that one may produce similar changes in animals by the use of anesthesia. The outstanding changes in the blood of an eclamptic woman are: a hyperglycemia, a high uric acid, an increased lactic acid, a low CO<sub>2</sub>-combining power, and often an elevated inorganic phosphorus. The changes produced in the blood sugar,<sup>2</sup> the CO<sub>2</sub>-combining power,<sup>3</sup> and the lactic acid<sup>4</sup> under certain of the general anesthetics, suggested a similarity in the blood changes in these two conditions.

#### METHODS

All determinations were made on dogs that had been starved for 18 hours preceding the experiment. In every instance an initial blood specimen was obtained, usually from the saphenous vein, at about nine o'clock on the morning of the experiment. Subsequent blood samples were taken at different intervals as indicated in the various protocols and tables. An endeavor was made to use only dogs that were evidently quite healthy and normal and that had not been subjected to previous experimental work.

The blood constituents studied were the nonprotein nitrogen, urea nitrogen, sugar, uric acid, lactic acid, inorganic phosphorus, and carbon dioxide combining power. Sodium oxalate having been used as an anticoagulant, a Folin-Wu filtrate was made within half an hour after the blood was drawn. A sugar determination was immediately made on a portion of this filtrate by the method of Benedict<sup>5</sup>, while another portion was being treated with CuSO<sub>4</sub> and Ca(OH)<sub>2</sub> in preparation for the lactic acid determination, which was carried out according to the procedure of Clausen<sup>6</sup>, sulphuric acid being used for the formation of acetaldehyde from lactic acid. The remaining portion of the Folin-Wu filtrate was then analyzed for nonprotein nitrogen and uric acid by the methods of Folin<sup>7</sup>. The urea nitrogen was determined by the Van Slyke-Cullen modification of the Marshall method<sup>8</sup> and

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the  $\text{CO}_2$ -combining power according to the technic of Van Slyke<sup>9</sup>. Inorganic phosphorus determinations were made by the colorimetric method according to the modifications of Briggs<sup>10</sup>. All values are expressed in mg. per 100 c.c. of blood, except the  $\text{CO}_2$ -combining power, which is written in volumes per cent.

Normally, there is no, or exceedingly little, uric acid in the circulating blood of the dog. By diluting the standard solution it has been possible to obtain a comparison with the color produced in the blood filtrate of the normal dog. It must be pointed out, therefore, that the uric acid figures reported for dogs may not be absolute but they are of distinct value when employed for a comparison under different conditions. These criticisms do not apply to the uric acid values reported for the human.

#### PART I. ANESTHESIA

*Ether.*—Ether was administered by inhalation to six dogs. The blood changes were almost identical in the six animals, and Table I shows the typical variations, studied over a period of two hours. The following protocol demonstrates the effect of about half an hour's deep ether anesthesia.

TABLE I

## ETHER

TIME	PROCEDURE	$\text{CO}_2$	SUGAR	URIC ACID	LACTIC ACID	N. P. N.	PHOSPHORUS
9.43 A.M.	Blood specimen.						
	Ether started.	59.7	125	0.5	14.5	52.2	3.0
10.48 A.M.	Ether stopped.						
	Blood specimen.	51.2	187	0.6	14.5	52.2	3.3
11.01 A.M.	Blood specimen.	46.3	167	0.7	19.3	45.6	3.3
11.16 A.M.	Blood specimen.	50.3	167	0.6	19.3	46	3.3
11.46 A.M.	Blood specimen.	49.3	167	0.6	16.9	46	3.3
12.46 A.M.	Blood specimen.	58.8	167	0.5	15.7	46	3.0

*Dog No. 6.*—Male, weight 25 kg., 4/15/25; 9:50 A.M. First blood sample taken; 9:55 A.M. Ether started; 10:20 A.M. Deep anesthesia attained; 10:55 A.M. Second blood sample taken, while animal was still under deep anesthesia.

## ANALYSES OF THE TWO BLOOD SPECIMENS

	Before Ether	Under Ether
$\text{CO}_2$	63.1	41.2
Sugar	125	222
Uric Acid	0.9	1.2
Lactic Acid	14.5	18.1
Phosphorus	3.1	3.8
N. P. N.	55.0	56.0

In the ether experiments an attempt was made to induce varying degrees of anesthesia in the different dogs, in order to see whether any parallelism between the depth of anesthesia and the blood changes could be established, and also to observe to what extent asphyxia may play a part in the production of these blood changes. The results show a relationship between the depth of anesthesia and the blood changes produced, while they also indicate that asphyxia may play an important part in very deep ether anesthesia, but certainly not in light anesthesia.

*Chloroform.*—Chloroform was administered to five dogs. The changes produced in the blood constituents are shown in the following protocol as well as in Table II, where the studies are over a period of two hours after the anesthetic was stopped.

TABLE II  
CHLOROFORM

TIME	PROCEDURE	CO <sub>2</sub>	SUGAR	URIC ACID	LACTIC ACID	N. P. N.	B. U. N.	PHOSPHORUS
10.20 A.M.	Blood specimen							
	CHCl <sub>3</sub> started.	59.5	139	0.5	8.4	47.9	15.3	3.0
11.00 A.M.	CHCl <sub>3</sub> stopped.							
	Blood specimen.	56.7	182	0.6	10.8	51.3	18.1	3.5
11.15 A.M.	Blood specimen	51.9	220	0.8	14.5	46.0	19.1	3.0
11.30 A.M.	Blood specimen	51.9	210	0.8	13.3	45.0	15.8	3.3
12.00 N.	Blood specimen	55.7	200	0.6	13.3	45.0	10.6	3.1
1.00 P.M.	Blood specimen.	55.7	182	0.5	12.1	45.6	12.0	3.8

*Dog No. 12.*—Female, weight 11 kg., 4/22/26; 10:10 A.M. First blood specimen taken 10:20 A.M. Chloroform started; 10:35 A.M. Deep anesthesia; 11:05 A.M. Chloroform stopped; 11:20 A.M. Second blood specimen taken.

ANALYSES OF THE TWO BLOOD SPECIMENS

	Before Chloroform	After Chloroform
CO <sub>2</sub>	53.3	49.4
Sugar	134	213
Uric Acid	0.9	1.1
Lactic Acid	8.5	18.1
Phosphorus	2.0	2.5
N. P. N.	37.5	37.5

In two dogs death was produced by chloroform, and the blood changes noted were quite similar to, although far more striking than those given in the above protocol.

*Nitrous Oxide.*—The effect of nitrous oxide was studied in two dogs. The first dog died within forty minutes after the anesthesia was started, while in the second animal, there was a chance to observe the blood changes over a period of about three hours. The following protocol and Table III record the changes noted.

TABLE III  
NITROUS OXIDE

TIME	PROCEDURE	CO <sub>2</sub>	SUGAR	URIC ACID	LACTIC ACID	N. P. N.	PHOSPHORUS
9.20 A.M.	Blood specimen.						
	N <sub>2</sub> O started.	56.0	121	0.5	8.5	32.8	2.5
9.40 A.M.	N <sub>2</sub> O stopped.						
	Blood specimen	41.9	189	0.5	15.7	33.9	2.5
9.55 A.M.	Blood specimen	43.8	182	0.7	31.4	38.7	2.5
10.10 A.M.	Blood specimen	47.5	200	0.5	31.4	37.5	2.8
10.50 A.M.	Blood specimen	52.2	200	0.5	14.5	34.1	2.8
11.50 A.M.	Blood specimen	52.2	189	0.5	13.3	31.6	3.2

*Dog No. 10.*—Female, weight 10 kg., 4/20/26; 9:30 A.M. First blood specimen taken; 9:45 A.M. Nitrous oxide started. Deep anesthesia almost immediately; 10:20 A.M. Second blood specimen taken, just before death; 10:21 A.M. death.

## ANALYSES OF THE TWO BLOOD SPECIMENS

	Before $N_2O$	After $N_2O$
$CO_2$	51.9	41.9
Sugar	143	299
Uric Acid	0.6	1.0
Lactic Acid	9.6	27.7
Phosphorus	2.3	3.0
N. P. N.	50.0	51.4

It is my opinion that there was a certain amount of asphyxia just before death, and thus the changes recorded in Table III represent perhaps more accurately the effect of nitrous oxide.

*Ethylene.*—The following protocol is that of a dog to which ethylene gas was administered by two trained anesthetists from this hospital.

*Dog No. 23.*—Male, weight 14 kg., 5/7/26; 10:00 A.M. First blood specimen taken; 10:40 A.M. Ethylene anesthesia started; 11:40 A.M. Second blood specimen taken after twenty minutes of deep anesthesia.

## ANALYSES OF THE TWO BLOOD SPECIMENS

	Before $C_2H_4$	After $C_2H_4$
$CO_2$	54.2	51.6
Sugar	98	125
Uric Acid	0.6	0.8
Lactic Acid	17.5	27.7
Phosphorus	1.7	2.5
N. P. N.	52.4	39.2
Urea Nitrogen	19.6	19.6

From the above protocols and tables, it will be seen that all four general anesthetics used produced about the same changes in the blood chemistry of the dog. These changes may be stated as follows:

- (a) A lowering of the  $CO_2$ -combining power.
- (b) A hyperglycemia.
- (c) An increase in lactic acid.
- (d) A slight increase in uric acid.
- (e) A slight increase in inorganic phosphorus.
- (f) No or very little disturbance in the nonprotein and urea nitrogen.

*Anoxemia.*—In the experiments with general anesthesia, it became apparent that often one had to deal with varying degrees of asphyxia. For comparison, I, therefore, subjected a dog to breathing an atmosphere containing 7 per cent oxygen. This was done by taking three Douglas bags, filling two with nitrogen and one with room air. The three bags were connected with one another, forming one large reservoir, with an oxygen content of about 7 per cent. A tight fitting mask, as previously described<sup>11</sup> was placed over the muzzle of the dog and connected by means of a Louven valve to the reservoir in such a manner that the dog inspired air containing 7 per cent oxygen. The animal was subjected to this type of breathing for half an hour, and the following blood changes were noted:

## ANALYSES OF THE TWO BLOOD SPECIMENS

	<i>Before breathing 7% O<sub>2</sub></i>	<i>After breathing 7% O<sub>2</sub></i>
CO <sub>2</sub>	51.9	40.4
Sugar	125	330
Uric Acid	0.6	0.8
Lactic Acid	15.0	54.9
Phosphorus	1.5	1.6
N. P. N.	38.7	34.1
Urea Nitrogen	15.8	16.4

As will be seen from these figures, the changes produced are almost identical with those recorded above for the general anesthetics. At this point it became necessary to know to what extent lack of oxygen or anoxemia may be a factor in producing those profound blood changes seen under general anesthesia. It seemed plausible that one could eliminate the factor of asphyxia, or at least limit it to a minimum by administering the anesthetic *per rectum* and in such amounts as not to interfere with the rate and depth of respiration. To two dogs ether was given *per rectum* according to the technic of Gwathmey<sup>12</sup>. Both animals showed the typical anesthesia blood changes and the following protocol represents a very light Gwathmey ether anesthesia.

*Dog No. 28.*—Female, weight 16 kg., 5/18/26; 9:00 A.M. First blood specimen taken; 9:10 A.M. Mixture of 65 per cent ether and 35 per cent olive oil introduced into rectum. Amount used about 9 c.c. per kilogram. A light anesthesia produced. 10:10 A.M. Second blood specimen taken.

## ANALYSES OF BLOOD SPECIMENS

	<i>Before Gwathmey</i>	<i>After Gwathmey</i>
CO <sub>2</sub>	49.4	44.8
Sugar	91	189
Uric Acid	0.9	0.9
Lactic Acid	15.1	18.7
Phosphorus	2.1	1.7
N. P. N.	45.6	43.6
Urea Nitrogen	18.0	18.5

In neither dog was there an accumulation of uric acid in the blood, although both showed a lowered CO<sub>2</sub>-combining power, a hyperglycemia and an increased lactic acid under Gwathmey anesthesia. It is interesting to note that in both dogs the inorganic phosphorus changed definitely but in opposite directions; in the first animal the anesthesia produced a marked elevation in the phosphorus, while in the second, a lowering took place. The nonprotein nitrogen and urea nitrogen were not affected.

*Hypnotics.*—As indicated above, general anesthetics,—ether, chloroform, nitrous oxide and ethylene—all produce similar changes in the blood chemistry of the dog; the changes from ether being the most marked and those from ethylene the slightest. A hyperglycemia, a lowering of the carbon-dioxide combining power, an increased lactic acid content and a tendency towards uric acid accumulation, and elevated inorganic phosphorus values are the typical changes observed. It next became necessary to see what, if any, variations in the blood chemistry follow the use of hypnotics, and for this purpose I used morphine, chloral, chloralose, urethane, paraldehyde, veronal, and amytal. In this part of the work an attempt was made to give such doses of these hypnotics as would produce satisfactory anesthesia

without killing the animal, as recommended in Sollman's "Manual of Pharmacology." The procedure of obtaining blood specimens was the same as used for the general anesthetics.

In Table IV are given the results of analyses on blood specimens obtained before and after the administration of each of the eight hypnotics above mentioned. Three experiments were performed with morphine, two with amytal or isoamylethyl barbituric acid, and one with each of the other drugs; the latter evidently need corroboration. The outstanding finding is the hyperglycemia produced by all these hypnotics, except in the case of amytal, where the blood-sugar change is less than 10 mg. per c.c. of blood. With chloral and chlorotone the

TABLE IV  
HYPNOTICS

DRUG	SAMPLE	CO <sub>2</sub>	SUGAR	URIC ACID	LACTIC ACID	N. P. N.	B. U. N.	PHOS- PHORUS
Morphia	Before	57.5	108	0.8	13.2	48.0	18.7	2.5
	After	70.0	167	0.8	11.5	40.5	18.7	1.7
Chloral	Before	62.6	133	0.6		33.3		2.4
	After	53.2	149	0.6		30.9		2.4
Chloreitone	Before	54.1	94	0.6		33.3		2.4
	After	48.5	115	0.7		23.4		2.6
Chloralose	Before	59.3	103	0.5		53.6		
	After	52.6	233	0.5		50.0		
Urethane	Before	50.4	106	0.5		33		2.4
	After	51.3	182	0.6		40		2.3
Paraldehyde	Before	62.6	110	0.5		37.5		2.3
	After	45.8	169	0.6		35.7		1.9
Veronal	Before	53.2	118	0.6		35.3		2.6
	After	52.2	144	0.7		35.9		2.5
Amytal	Before	55.1	107	0.5	11.5	45.3	19.2	2.5
	After	60.0	115	0.5	18.3	43.0	20.1	2.8

elevation in blood sugar is also very slight, while with the other soporifics the increase in blood sugar is marked. There is a tendency for the CO<sub>2</sub>-combining power to be lowered, although we notice a definite rise with morphine, as well as a slight rise with urethane and amytal. To what extent loss of hydrochloric acid through vomiting may play a part in the production of this change in the direction of an alkalosis, is not clear. However, in one experiment with morphine, there was no vomiting, yet the CO<sub>2</sub> slightly increased. The other blood constituents showed only insignificant changes.

## PART II. ANHYDREMIA

The work of Volhard and his associates<sup>13</sup> on 'hypertension and higher protein-split products as well as that of Hashimoto,<sup>14</sup> Hofbauer<sup>15</sup> and others on histamine suggested the study of the blood constituents under certain of these intoxicants. Witte's peptone, histamine, and histamine-free albumose were used in these experiments.

The variations observed are recorded in Table V, and are strikingly similar with the three substances used. There is an increase to almost the same extent in sugar, uric acid, lactic acid, inorganic phosphorus and nonprotein nitrogen, and a nearly identical percentage decrease in  $\text{CO}_2$ -combining power in all three experiments.

It seems fairly evident that the picture resulting from any one of these three substances is partially that of blood concentration; in other words, that the moisture content of the blood is lowered. Hashimoto<sup>11</sup> obtained an increase of solids in the blood stream of from 6 to 17 per cent in acute histamine intoxication. In a healthy dog weighing 12 kg., I injected intravenously 50 mg. of histamine and found that the moisture of the whole blood fell from 82.5 per cent to 80.0 per cent within fifteen minutes. The blood moisture was determined by the technic described by Stander and Tyler.<sup>16</sup> Dale and Laidlaw<sup>17</sup> showed that the increased concentration of the blood

TABLE V

BLOOD CONSTITUENTS	DOG NO. 18 PEPTONE (0.5 GM. PER KG. INTRAVENOUSLY)		DOG NO. 17 HISTAMINE (30 MG. INTRAVE- NOUSLY IN 1:1000 SOLUTION)		DOG NO. 19 ALBUMOSE "A" (1.0 GM. PER KG. INTRAVENOUSLY)	
	Before	After	Before	After	Before	After
$\text{CO}_2$	49.4	29.6	54.5	34.1	50.2	27.1
Sugar	98	174	89	182	103	137
Uric Acid	0.8	1.1	0.7	1.0	0.6	1.0
Lactic Acid	18.11	30.18	19.3	36.2	24.2	91.7
Phosphorus	1.4	2.5	2.8	3.1	1.5	1.7
N. P. N.	55.9	93.6	44.7	54.6	36.1	64.6

in histamine shock is not due simply to dehydration of the blood, but to actual loss of plasma resulting from capillary dilatation. The work of Hashimoto suggests that there are various factors causing the increase in nonprotein nitrogen in the blood in acute histamine poisoning. A lowered excretion of nitrogenous substances in the urine as well as increased protein destruction may be among the causative factors. The significance of the blood changes produced with peptone, histamine, and histamine-free albumose will be discussed after the pathologic lesions following their use have been described.

### PART III. PATHOLOGY

Most of the animals were sacrificed shortly after the experiment in order to study the tissues microscopically. We found that the quickest and easiest method of killing the dog was a stab through the heart, the animal dying within half a minute. All tissues were immediately placed in 10 per cent formalin and put through the usual histologic procedures. In some instances, it became necessary to make fat-stain preparations.



The following histologic description of the tissues studied is taken from the notes of Dr. J. W. Williams, who was kind enough to examine the sections for me. In most instances we studied the liver, kidneys, heart muscle, pancreas, spleen, adrenals and lungs, but in the following description we give only the abnormal findings.

*Ether.*—Ether was administered to one dog for half an hour, and the animal was killed three hours later. The liver showed slight fatty degeneration, extending throughout the entire lobule, but there was no necrosis of liver cells. The kidney showed very moderate degenerative changes in the cells of the convoluted tubules.

*Chloroform.*—The effect of chloroform was studied in three dogs, and all showed the typical liver lesions.

*Nitrous Oxide.*—In two dogs, following the administration of nitrous oxide, there were moderate degenerative changes in the center of the lobule. These changes

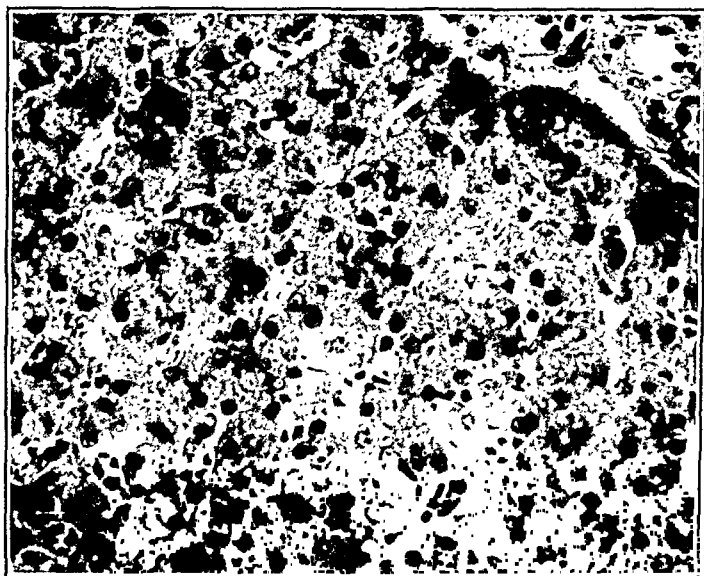


Fig. 1.—Section showing lobular changes in liver after nitrous oxide (x365).

are shown in Fig. 1. Fat stains were positive in the one and negative in the other dog.

*Ethylene.*—The effect of ethylene was observed in one dog. The liver cells showed slight degenerative changes throughout the lobule except at its periphery. Sudan III stain was positive. The kidney sections were normal.

*Gwathmey Anesthesia.*—To one dog ether was administered per rectum, as described above. The liver and kidneys revealed nothing abnormal. A Sudan stain for fat was negative for both the liver and the kidney.

*Histamine.*—We studied two dogs with acute and two with chronic histamine poisoning. All four animals showed marked degenerative changes in the liver and kidney. Except for a few cells at the periphery of the liver lobule, all of the cells showed marked changes. The protoplasm presented a honeycomb structure with a thin unchanged margin. The nuclei in general were well preserved, though in a certain number of cells they were lacking. The degenerative changes in the kidney were restricted to the convoluted tubules. Fat stains showed discrete rounded deposits of fat in all parts of the liver lobule, as well as in the convoluted tubules of the kidney. Fig. 2 demonstrates the changes in the liver.

*Peptone.*—One dog with acute and one with chronic peptone poisoning were studied. Both showed marked changes in the central portion of the liver lobule, not unlike those observed with histamine. There were also degenerative changes in the kidney tubules. Fig. 3 demonstrates the changes in the liver.

*Albumose.*—Two dogs received albumose injections, which produced marked changes throughout the liver lobule quite similar to those following histamine or

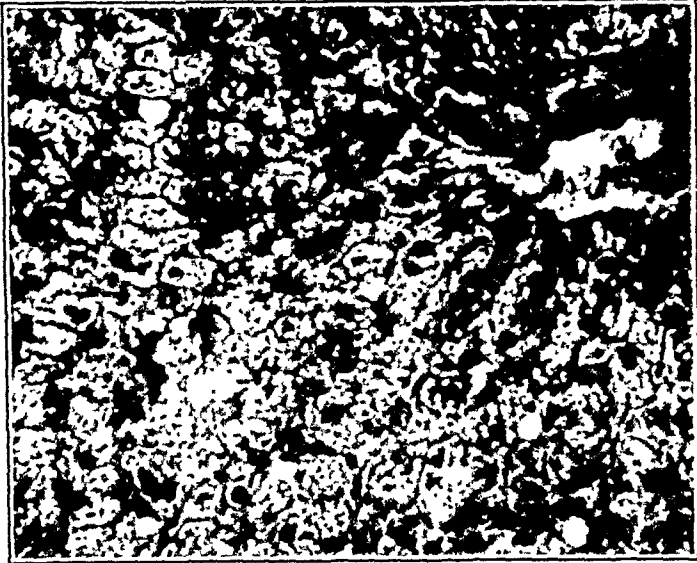


Fig. 2.—Liver changes after chronic histamine poisoning (x100).

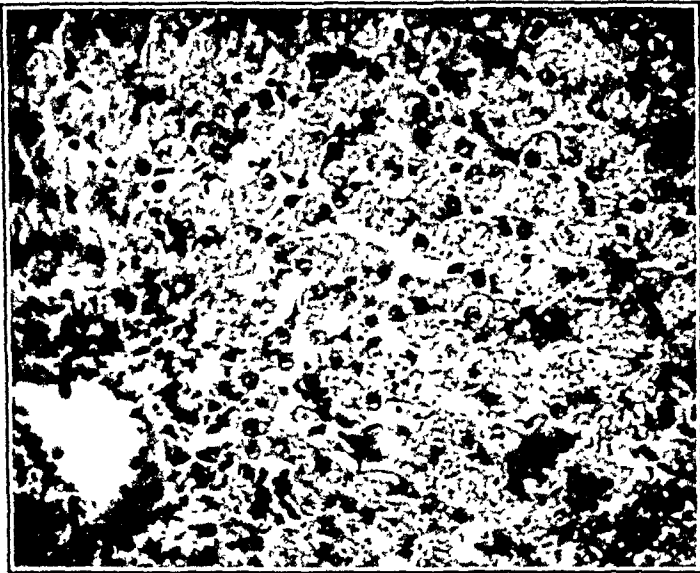


Fig. 3.—Liver changes after chronic peptone poisoning (x230).

peptone. The kidney changes were also very marked and of a destructive character restricted to the convoluted tubules.

*Magnesium sulphate.*—Two dogs, following magnesium sulphate injections, had marked fatty changes in the liver, as shown in Fig. 4. This section also shows numerous dilated capillaries and many spaces filled with blood. There were no, or only slight changes in the kidneys.

*Morphine.*—The effect of morphine was studied in one dog. Practically no changes were observed either in the liver or the kidney.

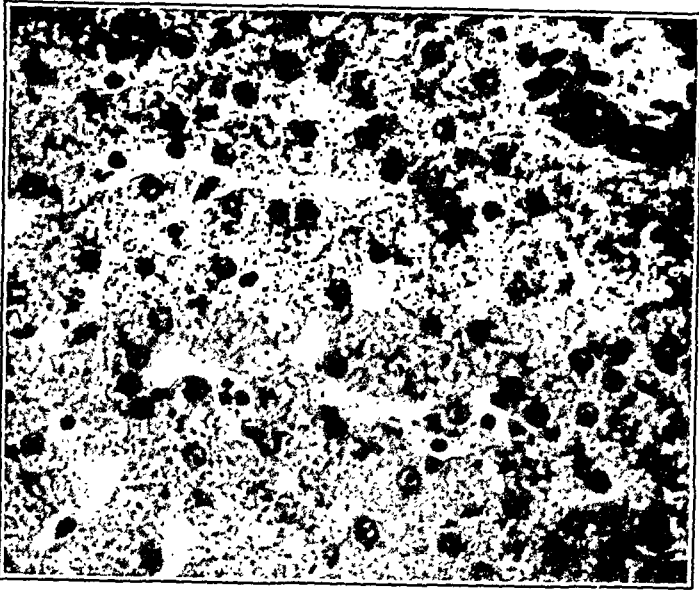


Fig. 4.—Fatty changes in liver after magnesium sulphate injections (x475).

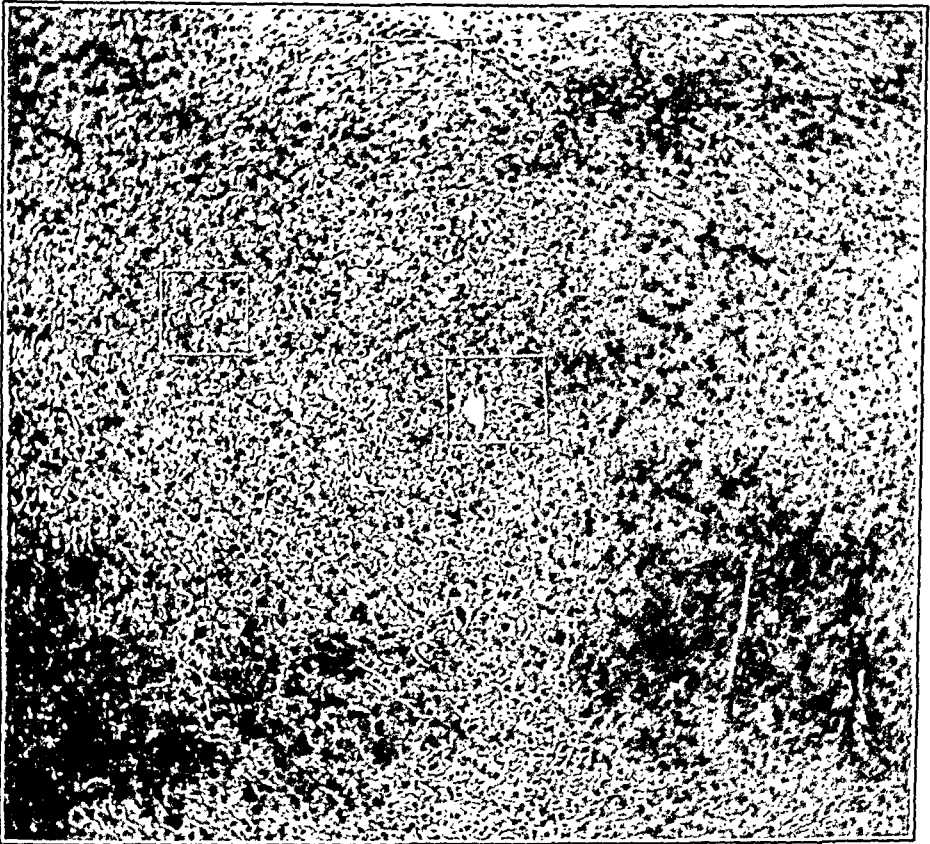


Fig. 5.—Changes in liver from anoxemia. (x150).

*Chloretone*.—One dog under chloretone showed no changes in the liver or the kidney.

*Chloral*.—One dog showed marked congestion of the liver, although a fat stain was negative.

*Veronal, Urethane, and Paraldehyde*.—Each of these substances produced marked generalized changes in the liver, whereas the kidney sections were quite normal.

*Anoxemia.*—The changes produced in the liver during the anoxemia experiment described above, are shown in Figs. 5, 6, 7 and 8. There were only slight changes in the kidney. Practically the entire liver lobule was involved. In the center, the cells presented a honeycomb appearance with a narrow peripheral margin of normal

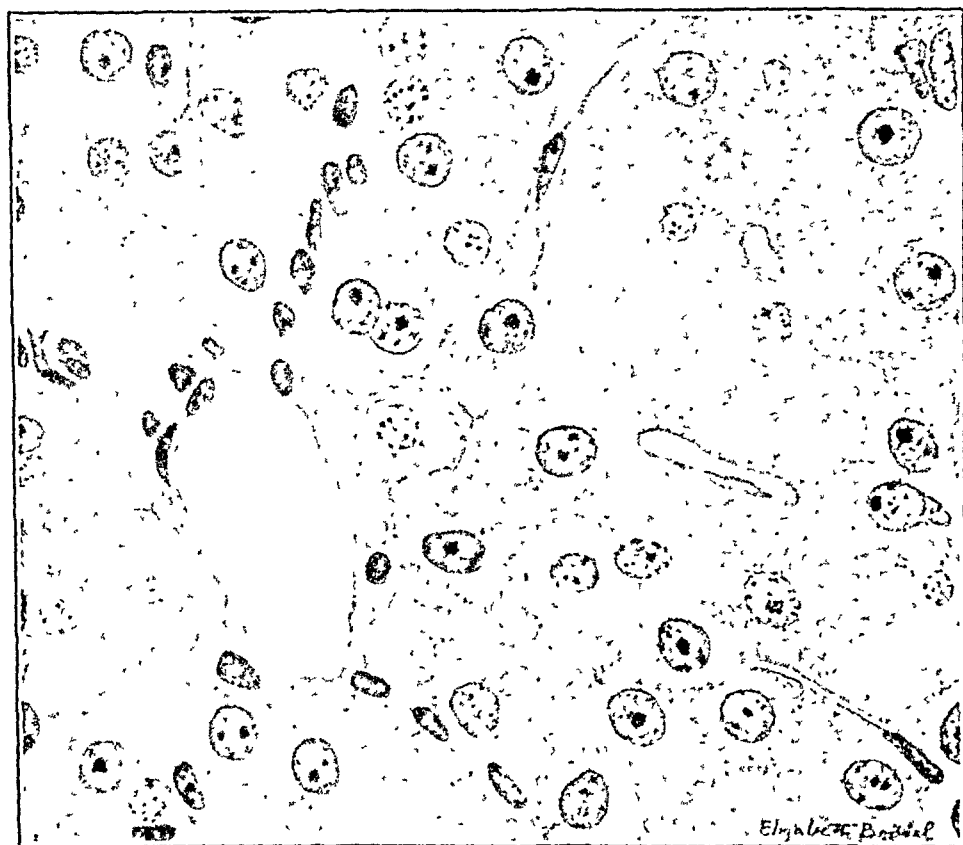


Fig. 6.—Anoxemia. Area around central vein as shown in Fig. 5. (x800.)



Fig. 7.—Anoxemia. Area near portal space as shown in Fig. 5 (x800.)

protoplasm. Many cells had lost their nuclei and appeared to be destroyed. At the periphery of the lobule a narrow margin of cells was better preserved, but still presented the same type of damage.

While it has been known for years that the prolonged administration of chloroform is occasionally followed by death, when autopsy

shows that it is associated with profound lesions of the liver, it has not been realized that similar, but less extensive, changes occur after the administration of the other general anesthetics, namely, ether, nitrous oxide, and ethylene. Our investigations, which we admit are incomplete, show that marked fatty changes occur in the central portion of the liver lobule, or throughout its entire extent in dogs which have been anesthetized by these agents for so short a period as fifteen minutes, and that the changes are least pronounced when ethylene is employed. Moreover, it should be noted that degenerative changes

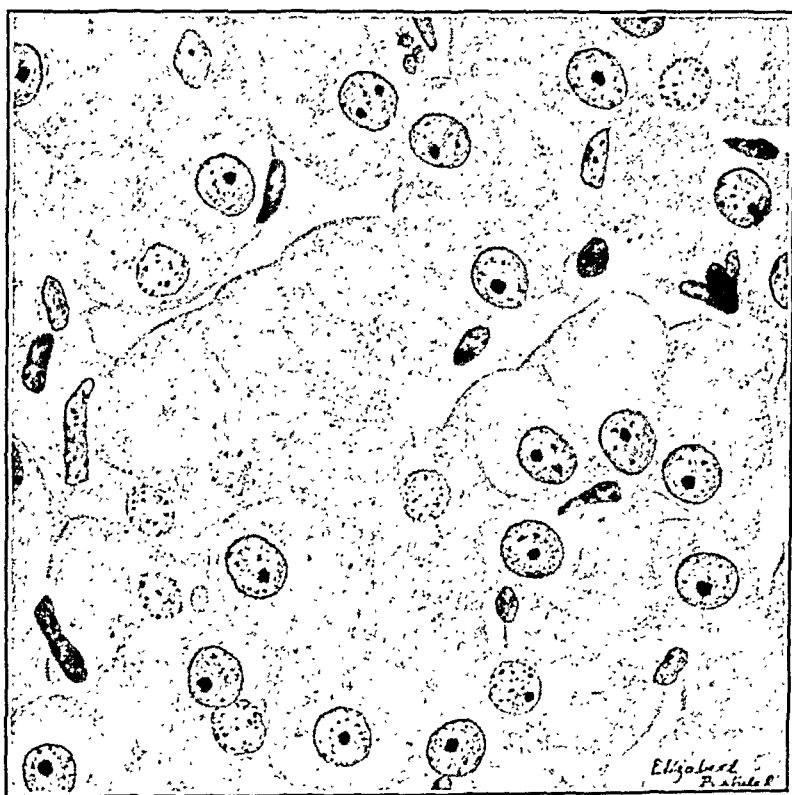


Fig. 8.—Anoxemia. Area near periphery of lobule as shown in Fig. 5. (x900.)

likewise occur in the epithelium of the convoluted tubules of the kidney, and were absent only when ethylene was used.

We cannot assert that similar changes occur in human beings, but reasoning by analogy it is likely, and for that reason the histologic lesions reinforce the deduction drawn from the chemical study of the blood that greater caution should be exercised in the administration of general anesthesia, and particularly in eclampsia.

It should be strongly emphasized that the lesions observed are in no way analogous to those characterizing eclampsia, nor do we make any claim that they are directly responsible for the blood changes described in this study. They are, however, the result of the anesthetic, and it would in general appear inadvisable to employ any

agent in the treatment of eclampsia which we know will lead to still further injury of the already damaged liver and kidneys.

It is of interest to note that in the single instance in which ether was administered *per rectum* by Gwathmey's method, no lesions were observed, though it must be admitted that further observation is necessary before this can be accepted as the general rule. Moreover, it is important to note that the use of magnesium sulphate was associated with the deposition of fat in the liver in large droplets, as well as by slight injury to the kidneys. The former changes, however, were distinctly localized, but were in no way similar to the generalized changes following the use of general anesthesia, or of the various substances to be mentioned later.

When histamine was administered in such large doses as to lead to death, the degenerative changes in the liver and kidney were slight; whereas, when it was administered in small doses for eight or ten days, marked degenerative lesions were produced. These involved the greater part of the lobule, and left free only a rim of cells about its periphery; they closely resembled the changes sometimes observed in fatal cases of vomiting of pregnancy. That the change was in great part fatty was abundantly proved by preparations stained with Sudan III. Marked changes likewise occurred in the epithelium of the convoluted tubules of the kidney. Too much stress, however, cannot be laid upon the fact that the hepatic lesions bear no likeness to those observed in eclampsia.

As one might suppose, *a priori*, identical changes followed the use of peptone and albumose.

It was a matter of surprise that in the anoxemia experiment the entire liver showed signs of marked change in the way of degeneration and necrosis of cells in all parts of the liver lobule, as well as minor changes in the convoluted tubules. As the tissue failed to stain with Sudan, it seems fair to assume that the change was not associated with the deposition of fat, and for that reason it must differ from those thus far described. Resnik and Keefer, in their anoxemia experiments, also produced anatomic changes in the liver, similar to those seen in chronic passive congestion.<sup>15</sup> The lesion following the use of the various hypnotics is of great importance, but as hypnotics were administered to only a single animal in each instance, it would be hazardous to attempt to draw binding conclusions as to their histologic action.

Morphia and chloretone alone gave rise to no lesions; chloral called forth intense congestion, with no serious cellular injury; while veronal, urethane and paraldehyde all gave rise to pronounced lesions in the liver and to very slight ones, or none at all, in the kidney. In the former, the changes were generalized, and frequently

led to the death of the cells, but they did not appear to be associated with the deposition of fat as was shown by the negative results with specific fat stains.

#### PART IV. ECLAMPSIA

The changes observed in the blood of eclamptic patients are shown in Table VI, which gives the averages for analyses made during the past year in this Clinic. A comparison between the findings for normal pregnancy at term and for eclampsia reveals the hyperglycemia, the acidosis, and the increase in uric and lactic acids in the latter condition. In order to bring out the marked similarity between

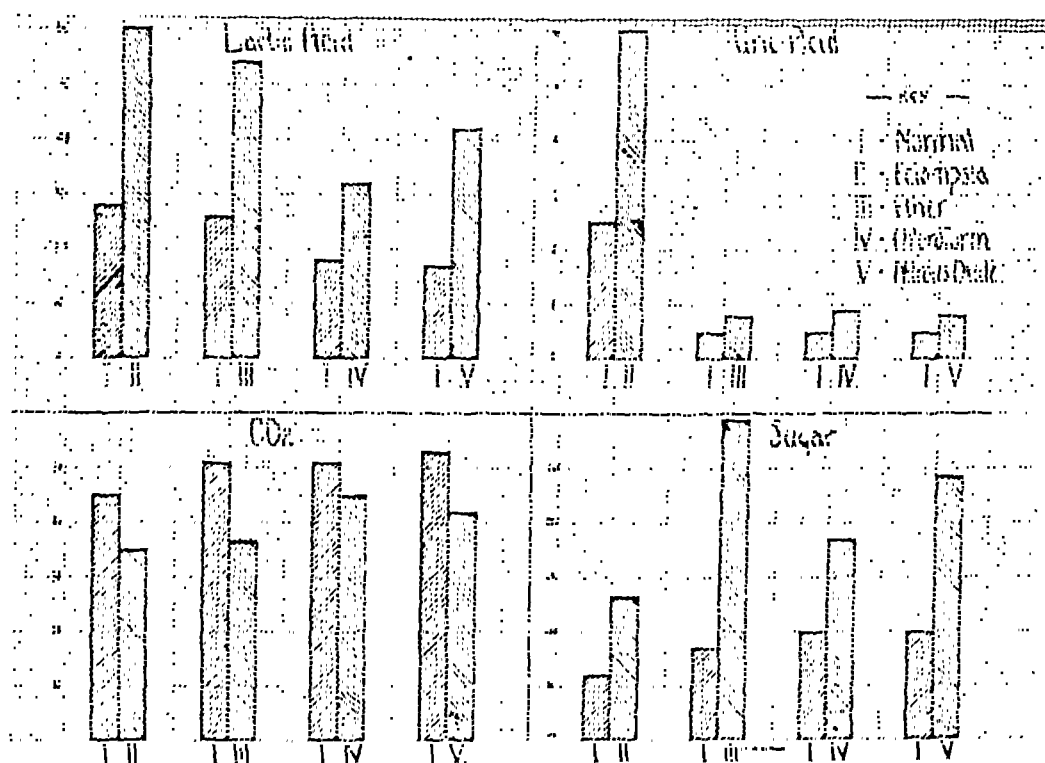


FIG. 9.

the blood changes in eclampsia and in general anesthesia, Fig. 9 has been constructed. The average values for six experiments with ether, five with chloroform, and two with nitrous oxide, as well as the figures in Table VI, form the basis for this graph.

TABLE VI  
ECLAMPSIA

CONSTITUENT	NORMAL PREGNANCY	ECLAMPSIA
N. P. N.	28.7	34.8
B. U. N.	13.2	13.4
Uric Acid	2.8	6.3
Sugar	98	155
Lactic Acid	30	91
Phosphorus	2.7	3.5
CO <sub>2</sub>	44.7	35.2

The obvious deduction from this similarity in the blood changes in eclampsia and in general anesthesia is that the condition of the eclamptic patient may be seriously aggravated by superimposing upon an already existing toxemia another due to general anesthesia. Furthermore, it seems quite logical to assume that the better results following the conservative treatment of eclampsia as compared with radical treatment, such as accouchement forcé and cesarean section, are due not to the change in treatment but rather to the fact that fewer eclamptic women are subjected to anesthesia in the conservative technic.

Thalhimer<sup>19</sup> introduced the use of insulin for combating postoperative acidosis as well as vomiting of pregnancy. This therapy has also been extended to include the acidosis of eclampsia<sup>20</sup> in this hospital. I have conducted eight experiments with general anesthesia followed by insulin. The changes observed in all these experiments were similar, whether insulin followed the administration of ether, chloroform,

TABLE VII  
ETHER-INSULIN

CONDITION	CO <sub>2</sub>	SUGAR	URIC ACID	LACTIC ACID	PHOSPHORUS	N. P. N.
Normal	63.1	125	0.5	14.5	3.1	55.0
After ½ hour Ether	41.2	222	0.8	18.1	3.8	56.0
15 minutes after Insulin	45.3	210	0.7	13.3	3.0	54.0
½ hour after Insulin	47.1	182	0.5	8.7	3.0	54.6
1 hour after Insulin	50.5	113	0.5	6.1	3.1	54.1
2 hours after Insulin	52.0	48	0.5	6.0	3.0	54.7
Remarks	Ether was stopped after one-half hour and the dog received immediately 100 units of insulin, intravenously.					

or nitrous oxide. A typical ether-insulin experiment is reported in Table VII, in which one sees that insulin not only relieves the acidosis and hyperglycemia, but has also a marked effect on the lactic acid content of the blood. This effect of insulin is similar to that reported by Stander and Radelet<sup>1</sup> in the treatment of eclampsia. It must be emphasized, however, that where insulin is employed to treat the acidosis of eclampsia, one should have definite information regarding the blood sugar and carbon dioxide combining power, and should always give a protective dose of glucose amounting to approximately 2 grams per unit of insulin.

During the past year, magnesium sulphate has been advocated for the treatment of eclampsia.<sup>21</sup> For this reason it seemed necessary to study the effect of this substance on the blood constituents. Two dogs were accordingly given injections of MgSO<sub>4</sub>, and the results are reported in Table VIII. The only changes observed are a lowering of the CO<sub>2</sub>-combining power and a slight increase in the blood sugar. From the evidence so far adduced, and the histologic findings already referred to, the use of MgSO<sub>4</sub> in eclampsia seems dubious, and it ap-



TABLE VIII  
MAGNESIUM SULPHATE

BLOOD CONSTITUENTS	DOG NO. 32 50 C.C. 50 PER CENT MgSO <sub>4</sub> SUBCUTANEOUSLY		DOG NO. 33 6 C.C. 50 PER CENT MgSO <sub>4</sub> INTRAVENOUSLY	
	Before	After	Before	After
CO <sub>2</sub>	63.6	55.1	61.5	54.1
Sugar	102	147	105	127
Uric Acid			0.5	0.5
Lactic Acid	30.1	41.8	12.1	14.4
Phosphorus	2.5	2.5	2.5	2.5
N. P. N.	40.6	40.6	50.0	51.1

pears to me imperative that more experimental work should be done in order to determine the value of this substance in the treatment of eclampsia.

Stroganoff<sup>22</sup> advocates the use of morphine in treating eclampsia. In this connection, it is interesting to observe the blood changes produced by morphine, as reported in Table IV. Morphine has a definite tendency to raise the CO<sub>2</sub>-combining power, and it may be due to this fact that the Stroganoff treatment is of value in the milder types of eclampsia. Hjort and Taylor<sup>23</sup> as well as Gauss<sup>24</sup> also demonstrated an increase in alkali reserve with morphine.

#### PART V. DISCUSSION

*Anesthesia and Eclampsia.*—We have noticed an acidosis and a hyperglycemia with the general anesthetics studied above. The effect of anesthesia on the acid-base balance of the blood has received a great deal of attention, and the experimental evidence at the present time strongly suggests that the same factors are not involved with each of the anesthetics. Ether and chloroform produce a fall in P<sub>H</sub> and alkali reserve, leading to an uncompensated alkali deficit, which is probably not dependent on respiratory variations and which, according to Leake,<sup>3</sup> is not caused by formation of ketone bodies or lactic acid. Leake states that a ketosis may develop several hours later as a result of deranged carbohydrate metabolism, related perhaps to a depressing action of ether or chloroform on insulin secretion. In this connection it is well to call to mind the work of Ross and Davis, on the part played by the pancreas in the production of ether-hyperglycemia. These investigators call particular attention to the influence of adrenalin, of sympathetic nerve endings, and of pancreatic secretion on the stored glycogen. While adrenalin and the sympathetic nerve endings influence the liberation of dextrose from glycogen, the pancreatic secretion has an inhibitory effect, i.e., prevents the liberation of dextrose from glycogen. The experimental work of these authors leads them to the conclusion that ether reduces the activity of the pancreatic secretion, resulting in a hyperglycemia, and

that chloroform, while having this same effect, in addition does injury to the liver cells, which would result in not so great a hyperglycemia.

On the other hand, there is evidence<sup>25</sup> suggesting that increase in blood or tissue acidity may produce a greater susceptibility toward a hyperglycemia. Koehler<sup>26</sup> has shown that the ingestion or intravenous injection of acids or acid-producing substances, resulting in a simple acidosis, has a marked effect on the fasting blood sugar of normal human beings. A hyperglycemia of 30 to 40 mg. per 100 c.c. of blood above the normal level follows a drop in  $P_H$  from 7.40 to 7.20. The author believes that the depressing effect of the acidosis upon the sugar metabolism may be related to "an acceleration of the inactivation of insulin by glucose due to increased H-ion concentration, especially when there is an overproduction or mobilization of the latter." In how far, then, the hyperglycemia following ether or chloroform anesthesia may be dependent on the initial acidosis or on its effect on the pancreatic secretion is as yet not quite clear. Mann<sup>2</sup> believes that the ether hyperglycemia depends wholly on the liver, as it does not occur when that organ is removed, and furthermore, that it depends chiefly on an intact portal circulation. He showed that ether also depresses the secretion of bile.

The recent work of Ronzoni and her coworkers<sup>1</sup> indicates that the acidosis of ether anesthesia may in a large part be due to the accumulation of lactic acid, rather than itself being the cause of lactic acid production as stated by Anref and Cannan.<sup>27</sup> It is possible, then, that the accumulation of lactic acid, due, say, to asphyxia, may result in an acidosis which in turn may lead to a hyperglycemia.

It seems well established that anesthesia with nitrous oxide cannot be produced unless we have a certain amount of anoxemia. The normal arterial blood is over 92 per cent saturated with oxygen at ordinary oxygen tensions inspired, while, according to Greene,<sup>28</sup> in nitrous oxide anesthesia, the arterial blood is less than 80 per cent saturated with oxygen. Anoxemia evidently then plays an important rôle in the production of the acidosis and hyperglycemia of nitrous oxide anesthesia. It is probable that with ethylene gas we also have to contend with a certain degree of anoxic anoxemia, although more oxygen can be given with this gas than with nitrous oxide.

Koehler, Brunquist, and Loevenhart<sup>29</sup> produced a rapid uncompensated alkali deficit by means of anoxemia. Our figures on anoxemia show that the carbon dioxide combining power dropped over 10 volumes per cent within half an hour of deficient oxygen breathing. This acidosis was accompanied by a marked accumulation of lactic acid in the blood stream together with a profound hyperglycemia.

Various theories have been advanced to explain the action of narcotics. The asphyxial theory of Verworn,<sup>30</sup> the lipoid theory of Meyer and Overton,<sup>31</sup> the cohesive theory of Traube, and the colloid

chemical theories have received a great deal of attention. The lipid and cohesive theories explain perhaps better the method of transportation than the mode of action of these drugs. It is probable that in general anesthesia we have to deal to a greater or lesser extent with a deoxygenating process. Greene<sup>28</sup> suggests that "the high solubility of nitrous oxide gas in some way interferes with the availability of oxygen, but whether this effect may be attributed to a tissue differential solubility, as in the case of ether, is still under investigation." In this connection, it may be well to note the effect of anesthesia on the lactic acid content of the blood. Our figures show a definite increase of blood lactic acid following the administration of anesthesia, and it is well established that deficient oxidation processes lead to an accumulation of lactic acid in the blood.<sup>32</sup>

It is interesting to observe that even with amytal, where we found only very slight changes in the blood sugar, recent work indicates that this substance has some effect on the metabolism of carbohydrates. Hines, Boyd, and Leese<sup>33</sup> showed that amytal anesthesia lessened the ability of an animal to handle glucose when injected by the continuous intravenous method. An animal so treated showed an increased hyperglycemia and glycosuria, associated with a slight lowering of the  $P_H$  of the plasma. They conclude that it is not safe to assume that amytal is associated with no alteration of carbohydrate metabolism.

The blood picture in eclampsia is so similar to that observed under anesthesia, that one wonders whether insufficient oxidation does not play a rôle in eclampsia. The idea seems quite plausible that any theory which tends to explain the causation of eclampsia should be linked up in some way or other with deficient oxidation.

*Anhydremia and Eclampsia.*—It should be stated at the outset that in eclampsia the blood is not more concentrated than in normal full-term pregnancy; on the contrary the work of Stander and Tyler<sup>16</sup> on blood moisture showed that in eclampsia the percentage of water in the blood stream may be great enough to constitute a true hydremia.

The above-recorded results obtained with peptone, albumose, and histamine indicate that these substances produce an anhydremia which in great part explains the blood changes observed. It must also be noted that these substances produce similar liver lesions, wholly different, however, from the eclamptic liver lesion. The liver lesions observed under peptone, albumose, or histamine poisoning are very similar to those seen in fatal vomiting of pregnancy, but before one can assume a connection between any of these substances and vomiting of pregnancy, it will be necessary to determine exactly what rôle starvation may play in the liver lesion of the latter condition, as well as to observe the effect of these substances when given in small amounts to animals throughout the course of pregnancy. It will, fur-

thermore, be necessary to study the blood in vomiting of pregnancy with particular reference to these substances.

The blood pressure in eclampsia<sup>24</sup> is decidedly elevated above the normal, whereas with peptone, albumose, and histamine,<sup>25</sup> we observe a fall in blood pressure. Nevertheless, although eclampsia is associated with a high blood pressure, a tendency towards a hydremia and peripheral necrosis in the liver, while the three substances under discussion produce a fall in blood pressure, an anhydremia and a characteristic liver lesion which is not peripheral, we feel that from the work of Volhard and his associates<sup>13</sup> it is imperative that further investigations on the higher protein-split products should be carried on. We have, accordingly, started to analyze the blood of all patients suffering from a toxemia of pregnancy for amino-acids before and after hydrolysis. Our figures are as yet too few to permit of any conclusions.

*Treatment of Eclampsia.*—The chemical and pathologic findings with anesthesia strongly indicate that the eclamptic patient should not be subjected to a general anesthesia. From the results recorded in this paper it seems quite logical to assume that the reduction in maternal mortality in eclampsia incident to the change from radical to conservative treatment<sup>26</sup> is due not to the change in procedure but rather to the fact that a much smaller proportion of patients received general anesthesia.

Our chemical and pathologic findings further indicate that the use of magnesium sulphate to control the convulsions is not warranted. We feel, however, that further work along these lines is required before any sweeping statement can be made.

In the case of morphine and chloral the evidence is of such a character that one may expect beneficial results from their use. Morphia apparently produces no liver lesions, and furthermore, has a definite tendency to raise the carbon dioxide combining power of the blood; chloral, while it seems to give rise to congestion of the liver, does not lead to damage of its cells.

The use of insulin with a protective dose of glucose in severe cases of eclampsia where the carbon dioxide combining power is 30 volumes per cent or lower, and where there is a hyperglycemia, seems quite justifiable from our clinical experience as well as from our experimental studies in animals on the effect of insulin on the various types of hyperglycemia and acidosis. It must be emphasized, however, that as far as we know at present, the only good that insulin may do in such cases is to combat the acidosis; and I feel convinced that certain patients might be saved from a fatal outcome if one could successfully carry them over the marked acidosis so often encountered in eclampsia. It is equally true that we sometimes have a type of eclampsia where acidosis is not a characteristic feature, and yet the patient may succumb. It is

thus clear that our treatment must remain empirical and tentative until we definitely know the cause of eclampsia.

In connection with the acidosis and hyperglycemia of eclampsia, it is interesting to bear in mind the work of Mann<sup>37</sup> and his associates on the physiology of the liver. The blood picture of eclampsia certainly reminds one of the changes produced by removal of the liver, especially when one considers the high uric acid content of the blood together with the changes in blood sugar, lactic acid, and hydrogen-ion concentration. That glucose therapy may be of value in certain types of disturbed liver function seems quite rational. Mann suggests, for example, that glucose may be of value where the supply of glycogen in the liver is depleted, following the marked hyperglycemia of ether anesthesia.<sup>2</sup>

It follows logically that in certain of the toxemias of pregnancy associated with marked disturbance in liver function, as is evidenced by pathologic lesions in that organ, the use of glucose may be of value, and there is clinical evidence to show that this contention may be correct. Duncan and Harding,<sup>38</sup> Titus<sup>39</sup> and others have advocated the use of glucose in the vomiting of pregnancy. It should be stated that in this clinic we have tried the glucose, as well as the insulin and glucose therapy for pernicious vomiting of pregnancy, and that while each of these treatments is of decided value in certain patients, we nevertheless encounter others in whom all attempts at treatment seem futile. This is not to be wondered at when we consider how little is as yet known concerning the etiology of the condition. Here, just as in eclampsia, our treatment must remain empirical and tentative until the true cause of the disease is discovered.

The results of our experimental work on general and local anesthesia lead to the conclusion that in certain of the severe types of eclampsia it may be advisable to end the pregnancy under local or spinal anesthesia, but as yet we have no clinical evidence in support of such a contention. In two control experiments on dogs, novocaine, or procaine, was injected subcutaneously in amounts greater than are ordinarily used in practice, and the blood chemistry studied. Twenty cubic centimeters of a 2 per cent solution of procaine were injected subcutaneously and produced no change in the blood constituents during a two hour period of observation in which samples of blood were withdrawn and analyzed at fifteen minute intervals.

As an analysis of the results obtained in the conservative treatment of ante- and intrapartum eclampsia up to March 31, 1926,<sup>42</sup> shows that the mortality was 1.9 per cent in the mild cases according to Eden's classification,<sup>40</sup> and 21 per cent in the severe cases, it appears that the treatment of the former by the Stroganoff technic<sup>41</sup> gives a very satisfactory result; while in the case of the severe type, improvement is

urgently demanded. For this reason, we have tentatively concluded to continue to treat the former by the Stroganoff method but to ascertain what results will follow the prompt delivery of severe cases under spinal anesthesia. When, however, the patient seems to be in danger from a profound acidosis as evidenced by a fall of the  $\text{CO}_2$ -combining power to 30 volumes per cent or less, we shall continue to use insulin and glucose which our experience up to this time indicates is of value in combating that condition.

#### CONCLUSIONS

1. Ether, chloroform, nitrous oxide, and ethylene produce changes in the blood constituents very similar to those seen in eclampsia.
2. These general anesthetics also produce pronounced liver lesions as well as less marked changes in the kidneys.
3. The use of these general anesthetics in the treatment of eclampsia seems open to objection.
4. Blood studies on anoxemia and eclampsia suggest that in the latter condition deficient oxidation may play a part.
5. Peptone, albumose, and histamine produce a blood picture suggesting an anhydremia. The evidence so far adduced, both chemical and pathologic, makes it improbable that any one of them is to be regarded as an etiologic factor in the causation of eclampsia.
6. Peptone, albumose, and histamine produce degenerative liver lesions similar to those associated with vomiting of pregnancy, but as yet we hesitate to assume that they play any etiologic rôle in its production.
7. The fact that morphine raises the  $\text{CO}_2$ -combining power of the blood and does not damage the liver, affords justification for continuing its use in the treatment of eclampsia.
8. The chemical and pathologic findings with magnesium sulphate speak against its use in eclampsia; but further work is necessary before a definite conclusion can be reached.
9. The use of glucose, as well as that of insulin and glucose, seems to be of value in certain cases of vomiting of pregnancy and eclampsia, but not in all.
10. In our experience, a modified Stroganoff technic, has led to a marked reduction in the mortality in mild cases of eclampsia.
11. The treatment of severe cases of eclampsia is not yet satisfactory and it is a question whether prompt delivery under spinal anesthesia may not give better results than we have heretofore obtained.

I am indebted to Dr. J. Whitridge Williams for his assistance in the histologic part of this work, and I am also grateful to Drs. E. K. Marshall, Jr., and E. M. K. Gelling for their many helpful suggestions. The credit for most of the lactic acid determinations belongs to Dr. A. H. Roderet to whom I am also grateful for assistance in many of the experiments.

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## HEMOSTASIS IN VAGINAL HYSTERECTOMY FOR PROCIDENTIA\*

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THE female pelvic organs may reasonably be expected to be complicated at times by various pathologic conditions which modify somewhat the indications and the usual technic for vaginal hysterectomy. One of these is a relaxation of the pelvic fascia which permits the uterus to descend and is usually associated with rectocele and cystocele. Histologic study of the fascia endopelvina demonstrates that it is developed by mesothelial condensations around the ureters and the pelvic nerves and blood vessels. Therefore, it seems reasonable to suggest that if the uterus is to be removed and the pelvic fascia utilized to support the bladder and rectum in cases of uterine prolapse, due consideration should be given to the pelvic veins and the technic for vaginal hysterectomy should be developed upon the principle of careful hemostasis.

Before describing such technic, it is essential to discuss briefly the reasons for removing the uterus in conditions of prolapse and to mention some of the complications that may be encountered. In cases of procidentia, it is frequently difficult to decide when to remove the uterus, and, if the uterus is to be removed, to weigh the advantages of abdominal over vaginal hysterectomy. It is also difficult to devise a method to suspend satisfactorily the vaginal vault after vaginal hysterectomy or to determine the limitations for justifiable pelvic dissection. The factors upon which surgical judgment should be based to make wisely these decisions vary with the individual patient and the experience of the operator. These self-evident statements are made because it is well known that vaginal hysterectomy is not always indicated, because cures of procidentia can at times be obtained by simple anterior colporrhaphy, perineorrhaphy and abdominal fixation of the uterus or by some modification of the interposition operation. Unfortunately, however, as with all hernias, there is invariably some percentage of recurrence after operation and this fear of recurrence is the primary reason for the great variety of procedures advocated for the cure of procidentia.

To minimize the danger of recurrence, some gynecologists recommend that the uterus be removed and the pelvic fascia be utilized to

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support the bladder, the vaginal vault and the rectum. To do this properly it is necessary to dissect rather extensively the vascular pelvic fascias and in so doing there is danger of operative and post-operative hemorrhage unless particular attention is given to complete hemostasis.

During the past fourteen years, 603 patients suffering with 1122 varieties of pelvic prolapse such as cystocele, rectocele and procidentia of the uterus have been operated upon in the Women's Clinic of the Stanford University School of Medicine. In an effort to determine the best way to permanently cure the largest number of these patients, with the least operative risk and the shortest period of hospital convalescence, various procedures have been utilized. Many patients have been observed for a long period of time in the follow-up clinic and several papers have been published which give the facts as we have observed them in regard to the percentage of recurrence after various methods of operation and the operative and postoperative complications experienced.<sup>1-2</sup>

In regard to recurrence, a recent study of 184 patients with pelvic prolapse showed that later in the clinic there was noted some recurrence in 21 patients or 11.4 per cent. Nineteen of the 21 patients had recurrent rectocele, 9 patients had recurrent cystocele and 2 patients had recurrent prolapse of the uterus. Sixty-two of the 184 patients in this series had the uterus removed either because they were past the menopause or because the uterus was pathologic which accounts somewhat, but not entirely, for the low incidence of recurrent prolapse of the uterus. Of the two patients having recurrent prolapse of the uterus, one followed an interposition operation and one followed a subtotal vaginal hysterectomy.

The operative and postoperative complications associated with hemorrhage have given the greatest concern and have influenced in a marked way, the development of the operative technic in the clinic. Of the 603 patients operated upon, one had severe postoperative hemorrhage following vaginal hysterectomy, two patients developed pelvic hematoma, one after a Jellett operation and one after a subtotal vaginal hysterectomy and two patients died with the symptoms of postoperative shock, both after subtotal vaginal hysterectomy.

These experiences have caused us to give up the subtotal vaginal hysterectomy<sup>3</sup> because we could not perfect a satisfactory technic to control hemorrhage without occasionally experiencing some degree of cervix sloughing which increased the incidence of recurrence. Since 1921, we have not done the Jellett operation<sup>4</sup> because with the extensive dissection involved, more difficulties were encountered with hemostasis than in cases where the uterus was completely removed. We reluctantly gave up the Goffe operation,<sup>5</sup> not because of hemorrhage,

but because one patient after operation developed a ureterovaginal-vesicovaginal fistula which was most difficult to close.

With the development of the present technic for hemostasis we have



Fig. 1.—Section of tissue between bladder and anterior wall of vagina, (x1).  
B, bladder, V, vagina.



Fig. 2.—Vesicovaginal fistula to show vascular condition under vaginal wall.

come to rely more and more upon complete vaginal hysterectomy for the cure of procidentia in women near or past the menopause.

In 1919, I presented to this Society a study of frozen sections of

the pelvis,<sup>3</sup> the photographs of which showed very clearly the fascia endopelvina. Since that time, further anatomic study of the pelvic fascia has been made. Some of the points brought out by these ana-

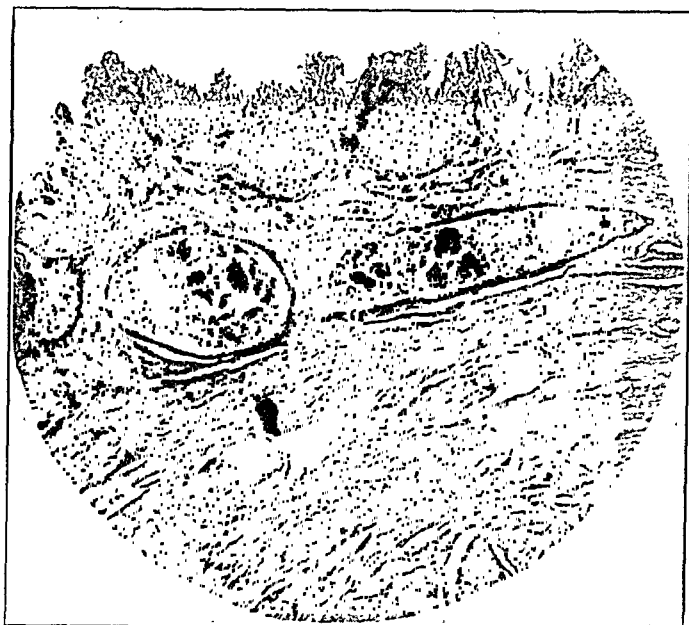


Fig. 3.—Vesicovaginal fascia to show vascular condition under bladder wall.

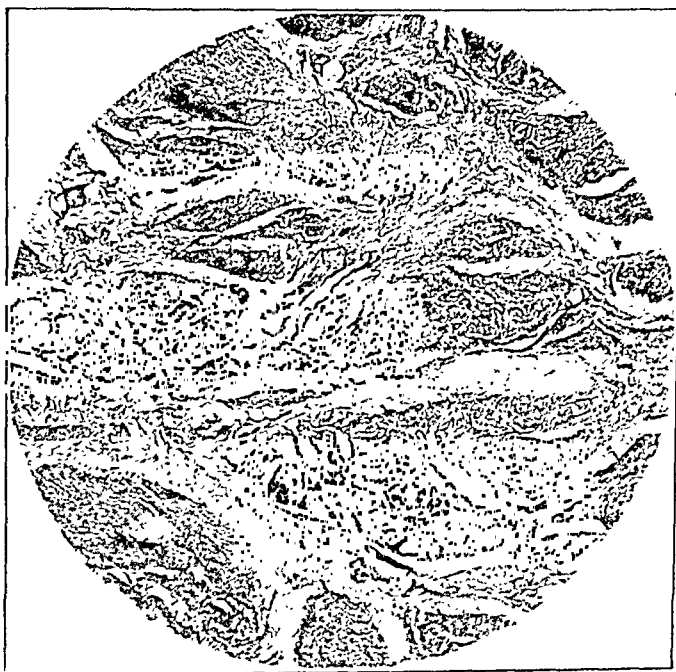


Fig. 4.—Vesicovaginal fascia. Intermediate portion.

tomic dissections have been utilized not only in the technic for the support of the bladder in cases of cystocele, but for the control of hemorrhage in vaginal hysterectomy. Fig. 1 shows a section of the tissue between the bladder and anterior wall of the vagina. Figs. 2,

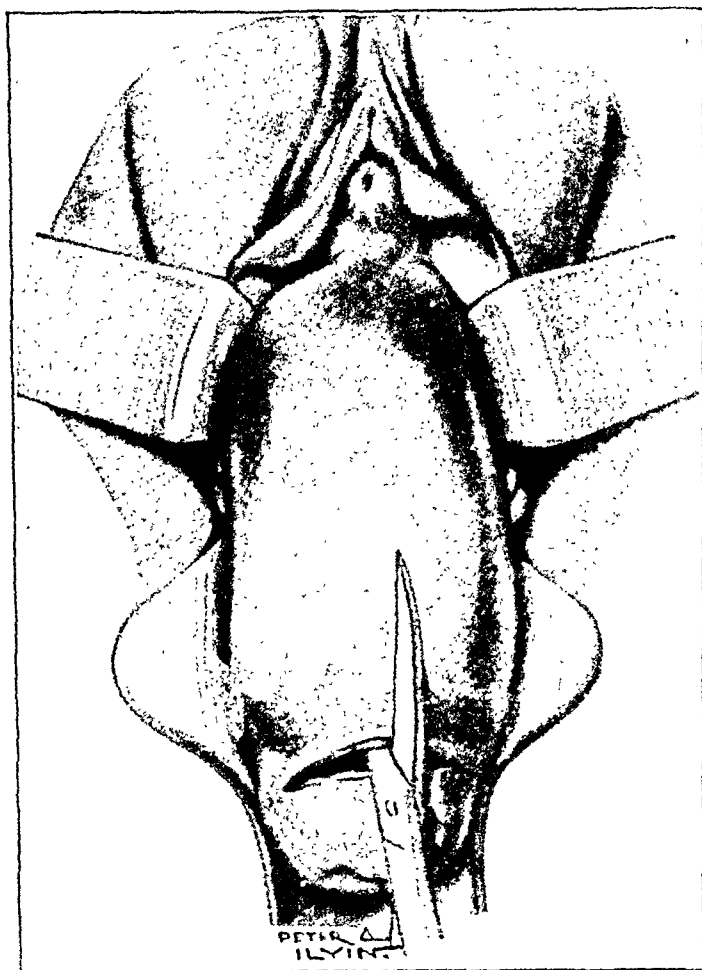


Fig. 5.—Separation of vaginal wall and vesicovaginal fascia from the bladder.



Fig. 6.—Posterior view to show relation of ureters to vesicouterine ligaments. *P*, Peritoneum of Douglas's pouch. *U*, ureters. *V*, vagina at cervix.

3, and 4 show the vascular condition of this tissue just under the vaginal wall and under the bladder wall with a thick muscular non-vascular layer lying between. The practical utilization of this vesico-

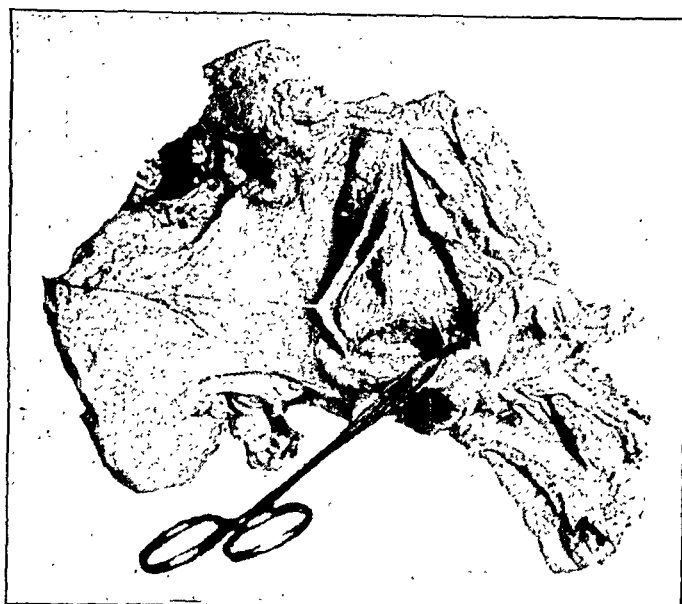


Fig. 7.—Anatomical dissection which shows anterior vaginal wall with dissected vesicovaginal fascia and bladder. Clamp has been placed on the left vesicouterine ligament.

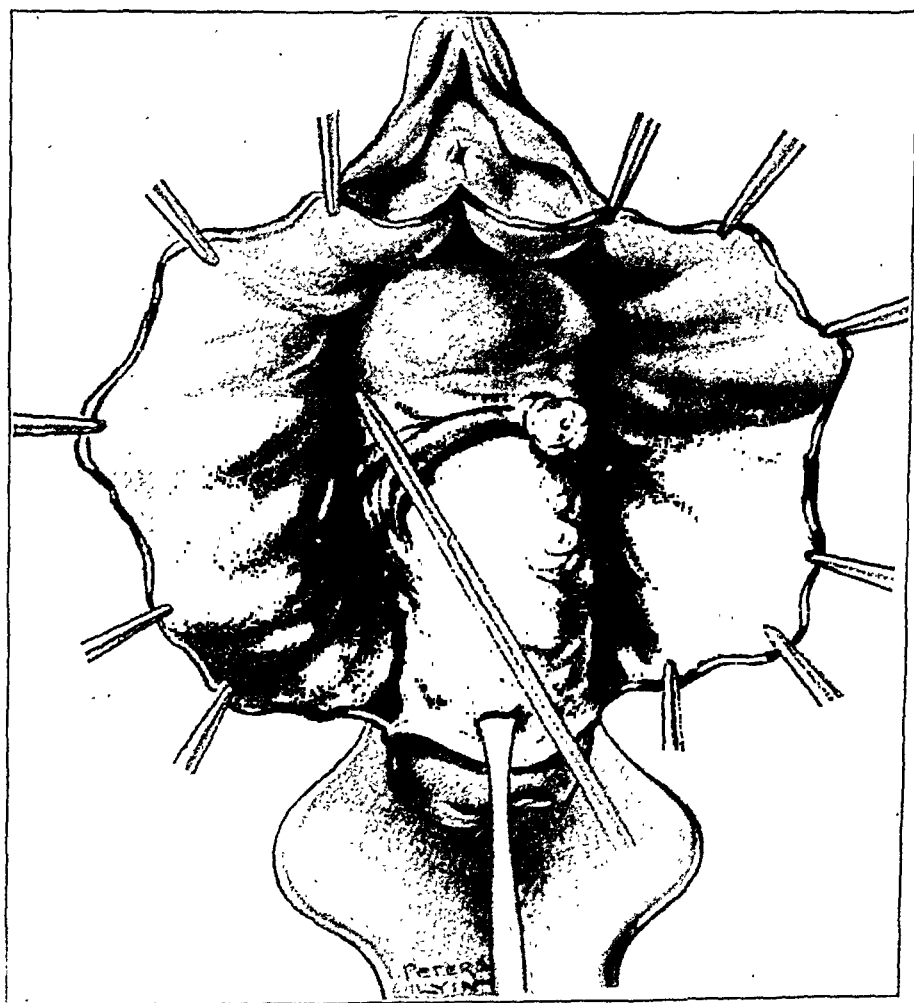


Fig. 8.—Ligation of left vesicouterine ligament. Hemostat placed on right vesicouterine ligament, previous to section,

vaginal fascia in the repair of cystocele as advocated by the late Dr. J. Craig Neel,<sup>6</sup> of San Francisco and by Dr. R. M. Rawls of New York,<sup>7</sup> has been made for the past ten years with fairly satisfactory results in regard to the incidence of cystocele recurrence. In separating this fascia from the bladder as shown in Fig. 5, the deep vascular layer should not be removed as it forms an important part of the bladder wall. The vesical plexus of veins lying in this part of the

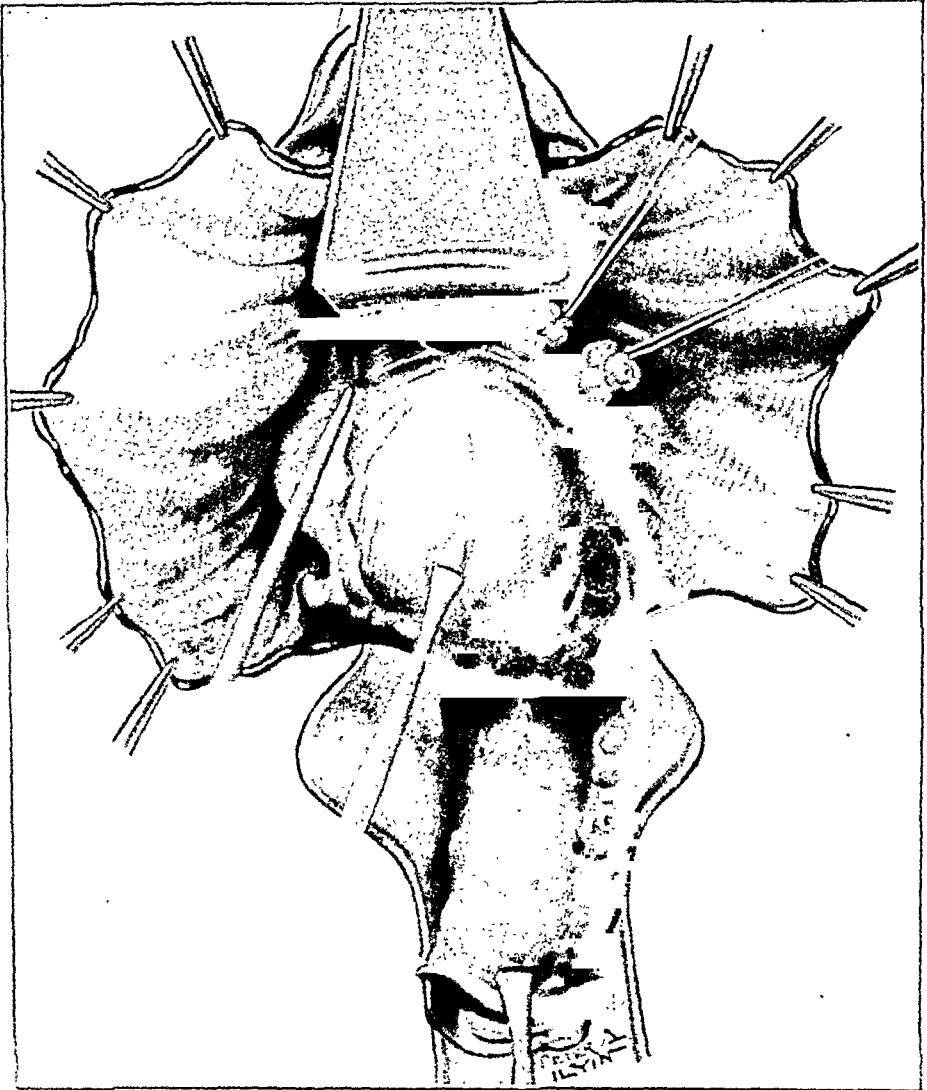


Fig. 2.—Delivery of fundus of uterus under Doyen clamp which protects bladder, to show separate ligation of round ligaments and broad ligaments.

fascia with the surrounding mesothelial condensations passes down the anterior wall of the bladder to form, on either side, the thick vesicouterine ligaments as the vessels pass to empty into the uterine veins. This fascia comes in quite close contact to the ureter as shown in Fig. 6 but can easily be clamped and ligated without injury to the ureter or injury to the bladder wall if the clamp is placed close to the uterus as shown in Fig. 7. With separate ligation of the vesico-

uterine ligaments not only can the bladder be more completely supported but the control of the venous oozing is perfect. By freeing the bladder completely from the anterior vaginal wall and from the midportion of the anterior uterine wall, the bladder can be lifted from the uterus producing tension on the two vesicouterine ligaments. These ligaments can then be safely clamped close to the uterus with a small straight hemostat if reasonable care is taken that the ureter

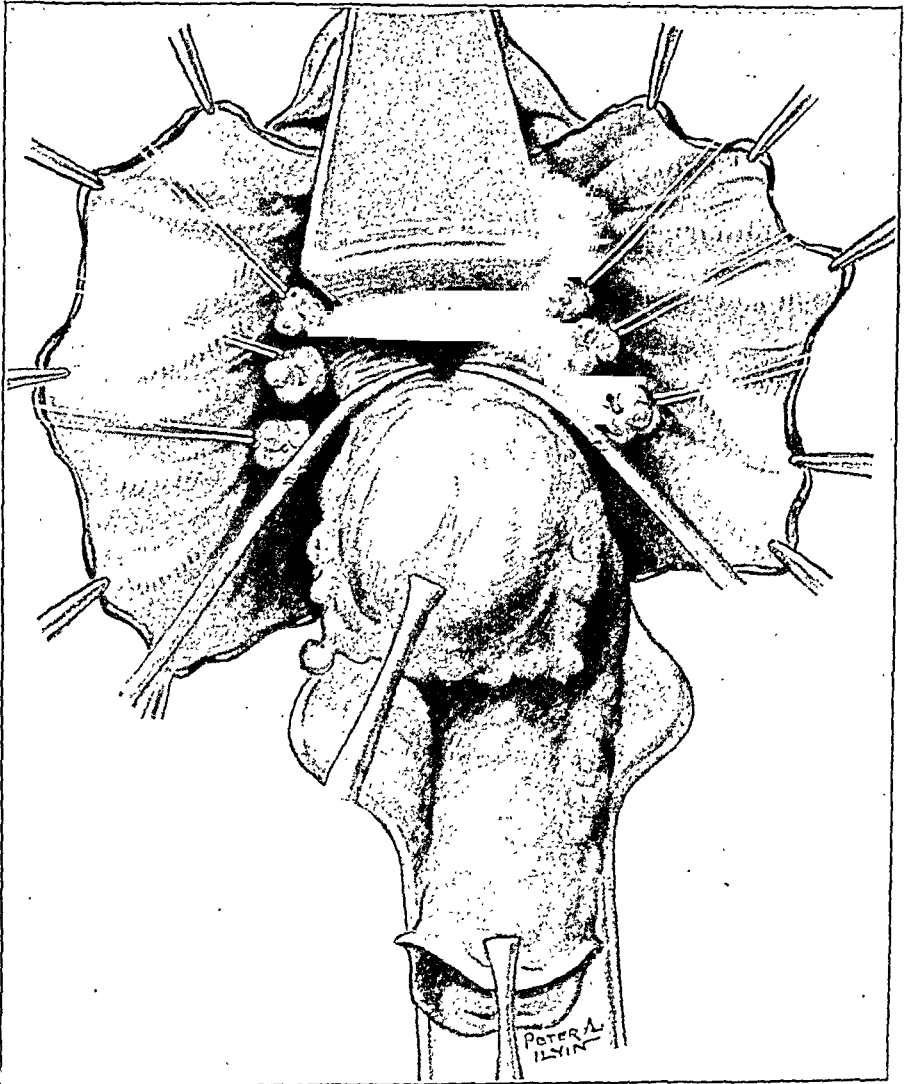


Fig. 10.—Separate ligation of sacrouterine ligaments.

is not in the clamp. The ligament can be cut close to the uterus and sutured on the bladder side with a ligature of small chromic gut around the clamp (Fig. 8). This technic has been used for over four years without injury to the bladder or ureter and with satisfactory control of operative and postoperative hemorrhage. After severing these ligaments, arterial hemorrhage is controlled by exposing and ligating the uterine arteries. The double ligatures on the uterine arteries are cut short but no attempt is made to utilize the base of

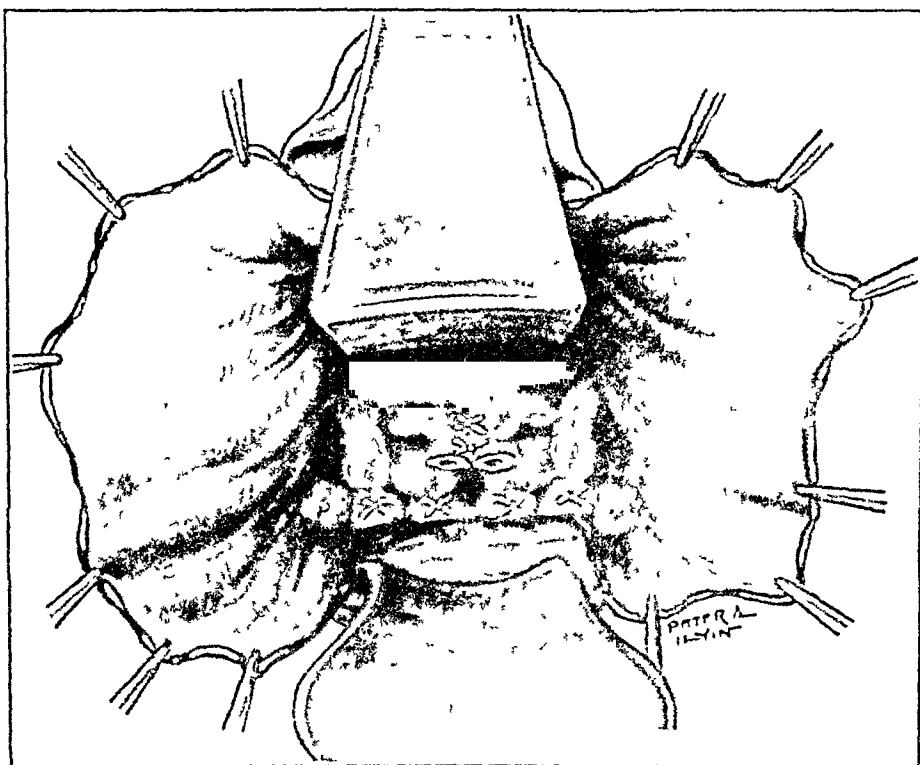


Fig. 11.—Round ligaments and sacrouterine ligaments sutured to posterior vaginal wall. Broad ligaments sutured under Doyen clamp

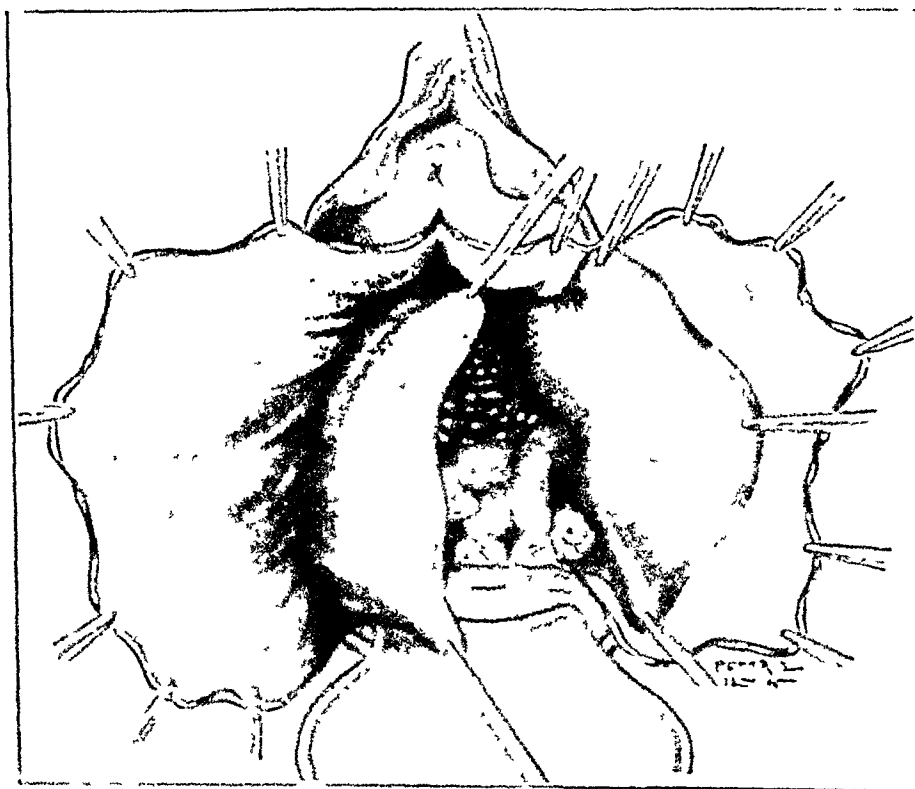


Fig. 12.—Vaginal cuff after hysterectomy. The lower edge of the vaginal wall is sutured to the surrounding tissue. Overlapping this fascia and suturing lower edge to vaginal wall supports the bladder.



the broad ligaments for the support of the vaginal vault as this would increase the danger of postoperative hemorrhage.

After opening the peritoneal cavity, under the bladder, the bladder can be protected with a wide Doyen retractor and the omentum and intestines packed off. This permits of delivery of the fundus of the uterus and separate ligation of the round ligaments and the adnexal connections (Fig. 9). By traction on the cervix and uterine fundus, the sacrouterine ligaments become taut and can readily be clamped, ligated and cut (Fig. 10). The uterus is then removed by section of the posterior vaginal wall. After suturing the sacrouterine ligaments and the round ligaments to the severed posterior vaginal wall, the stumps of the broad ligaments are brought together just under the

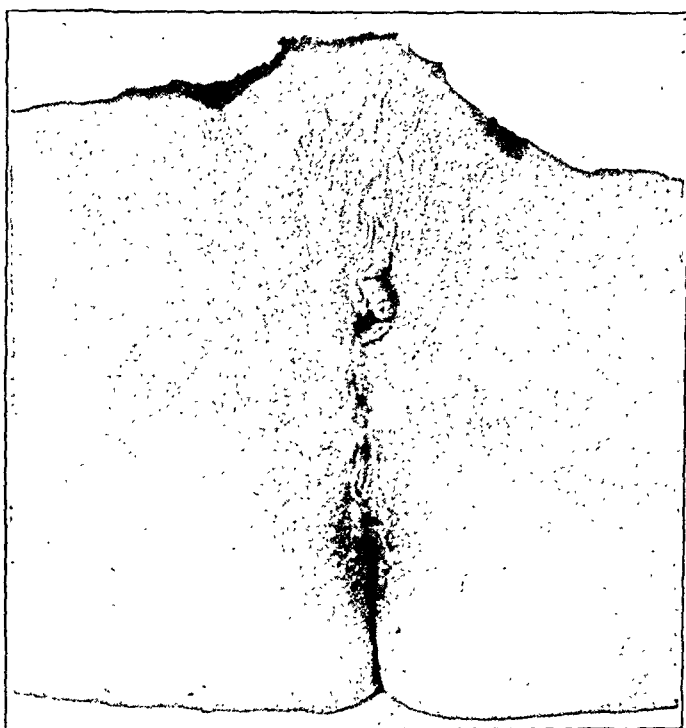


Fig. 13.—Shows condition of patient on leaving hospital fourteen days after operation.

junction of the urethra to the bladder (Fig. 11). Removing the retractor and the abdominal pack, a circular suture through the cut edges of the vagina, the round ligaments and the broad ligaments, closes the vaginal opening. If the vesicovaginal fascia has been freely dissected from the bladder and from the vaginal mucosa, it will usually be found to be quite thick. Overlapping this fascia (Fig. 12), suturing it to the edge of the vaginal vault under the bladder and closing the mucosa of the anterior vaginal wall with interrupted sutures, completes the operation. Almost always a proctopexy<sup>2</sup> and a perineorrhaphy is needed following which a light vaginal pack is usually placed. Fig. 13 shows the condition of a patient on leaving the hospital.

## CONCLUSIONS

In a series of 603 patients suffering with various conditions of pelvic prolapse, 90 have been treated by complete vaginal hysterectomy. Experiences with this operation have demonstrated the need for wide dissection of the pelvic fascia to close the hernial opening and minimize the danger of recurrence. As the pelvic fascia is developed around the ureters, the nerves, and especially the pelvic vessels, special technic is necessary to guard against postoperative hemorrhage. The particular point in such technic as illustrated in this paper has to do with the separate ligation and section of the vesicouterine ligaments.

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(For discussion see page 765.)

## THE TREATMENT OF GRANULOMA INGUINALE WITH TARTAR EMETIC\*

BY JOHN A. MCGLINN, M.D., PHILADELPHIA, PA.

SOME years ago I reported four cases of tuberculosis of the vulva, occurring on my service at the Philadelphia General Hospital. In the light of our present knowledge, we know that the cases were not tuberculosis, but granuloma. For fully fifty years this disease has been endemic in the hospital and was variously diagnosed as lupus or syphilis. It was not until 1921 when Randall, Small and Beck, becoming interested in the study of granuloma, found seven cases of the disease in the wards of the hospital, that the entity of the condition was recognized in Philadelphia. Since their studies the disease is regularly diagnosed and there is never a time when we do not have one or more cases in the hospital.

The true nature of the disease has been recognized for a number of years but, inasmuch as the early papers were published by South American physicians and as the disease is almost always found in negroes, it was regarded as a tropical disease and little or no attention was paid to it in the north temperate zone. Following the papers of Symmens and Frost in 1920 and Randall *et al* in 1921, interest was aroused in the subject with the result that cases have been recognized and reported from every section of the United States.

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\*Read at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 21 and 22, 1926.

All of our cases with two exceptions have occurred in the negro. One of our white cases was in a young married woman, age twenty-five, whose husband was free of venereal disease and whose personal habits of cleanliness were excellent. Before consulting us she had been a patient in two of our largest hospitals and in both the condition was diagnosed as inoperable cancer of the vulva and treatment by x-ray instituted. The case was, clinically, granuloma and biopsy and bacteriologic studies corroborated the clinical diagnosis. She refused treatment, left the hospital, moved from her former address and could not be traced.

The lesion starts usually with a small noninflammatory papule on the vulva. The papule ruptures and exudes a purulent fluid. Unlike

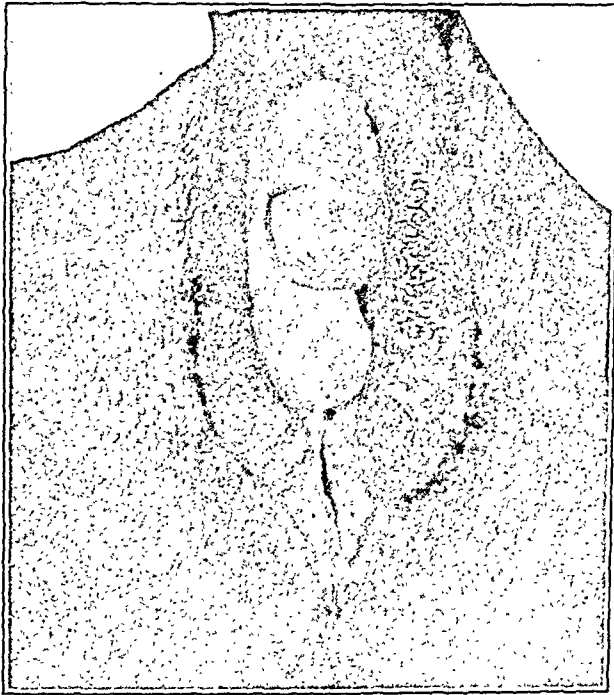


Fig. 1.—Early case of granuloma, showing an edema of the vulva.

most papules that rupture, healing does not take place but on the contrary spreads by slow proliferation. In the early stage, while it does not resemble a phagedenic ulcer, it is often mistaken for one and the usual escharotic treatment instituted. The typical lesion is that of exuberant granulation tissue, which is soft in structure and red in color. There is usually destruction in the center of the growth but the edges are exuberant and usually overlap the healthy skin edges. The surface is covered with a scanty mucoid exudate which, while nonoffensive, has a peculiar odor. I have frequently been able to anticipate the diagnosis of the case from the odor before seeing the lesion. When the exudate is removed a clean, red, healthy-looking granulating area is revealed. The advanced cases show large

granulating areas, with here and there cicatricial tissue and on the edges papules of new growths. It was this picture of beginning new growths, advanced growths and areas of healing that caused it to be confused with lupus.

The usual site of the disease is the labia majora but in the advanced cases the entire vulva and groin are involved. In not a few cases extension into the vagina has been observed and in one of our cases the rectovaginal septum was destroyed. Lymphatic circulation is interfered with and edema of the vulva is frequently observed.

Except for the presence of the growth there are few subjective symptoms. The lesion is painless and the usual symptoms and blood findings of infections are absent.



FIG. 2.—Advanced case of granuloma showing exudate.

Its insensitiveness makes it possible for the lesion to become an interesting complication of pregnancy. The presence of pregnancy in a well advanced case of granuloma proves the futility of attempting to inhibit the indulgence of natural desires.

Five pregnancies have occurred in three of our cases and we were unable to note any favorable or unfavorable effect upon the lesions. In all these cases the disease was far advanced, involving not only the entire vulva but the posterior wall of the vagina. Our most noted case, A. W., has had three pregnancies, the last in spite of the fact that she had a large rectovaginal opening with a profuse discharge

of feces into the vagina and over the vulva. In these three cases it was felt that vaginal delivery was contraindicated on account of the danger of infection and severe traumatism. Five cesarean sections were done with no fetal and one maternal death from pneumonia and paroxysmal tachycardia. One patient had three cesarean sections; one done on the service of Dr. Edward Schumann and was reported by him before a joint meeting of the New York and Philadelphia Obstetrical Societies several years ago.

The more or less definite clinical picture of granuloma makes the diagnosis comparatively easy, even without the aid of bacteriologic and histologic studies. In our cases, however, we make routine smears and biopsies and submit them to the laboratory for study. Little has

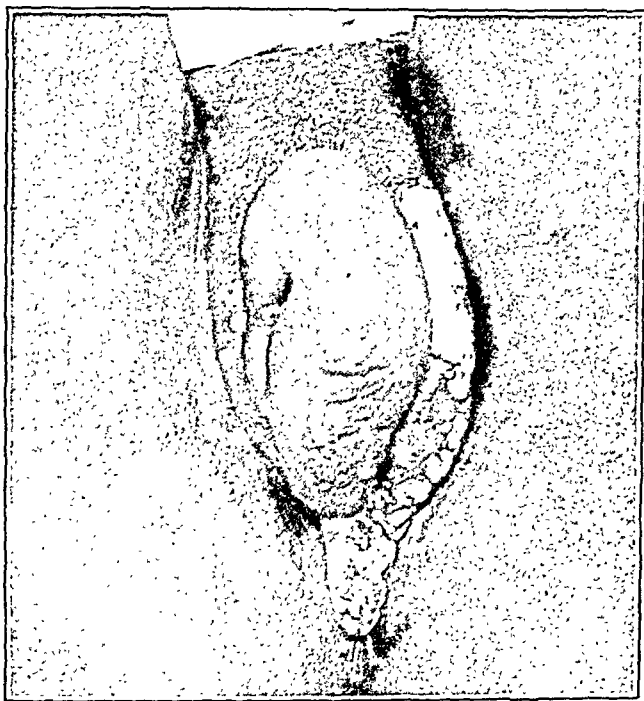


Fig. 3.—Moderately advanced case of granuloma showing exudate and edema of the vulva.

been added to our knowledge of the bacteriology and histology of granuloma since J. C. Small's studies made in our laboratories in 1921 and 1922, and whose findings will be freely quoted in this paper. As stated previously, mistaken diagnoses were always made prior to 1921. The most common error in diagnosis was to consider granuloma lupus or syphilis. Many other mistaken diagnoses were made, such as chancroidal sores, cancer, condylomata acuminata and condylomata lata. As might be expected many cases present a positive Wassermann and in former days were considered syphilis. As we have become familiar with the clinical picture of granuloma mistaken diagnoses are rarely made.

Direct smears from the lesion, made with a stiff wire loop, stained

either by the Wright or Giemsa method show the characteristic encapsulated bacillus first described by Donovan. When well stained the organisms appear as small, rounded, pink bodies with a dark blue coccoid body in the center; or more frequently as oval pink bodies with a blue bacillary or diplococcoid body occupying the longitudinal axis. The pink outer zone is a wide capsule. The dark blue central bodies represent metachromatic granules within the body proper. The organisms are found within the cytoplasm of large mononuclear cells. Bipolar staining may be observed at times in these nests of organisms. Encapsulated organisms may appear free in the cellular detritus in the neighborhood of disintegrating mononuclear cells.



Fig. 1.—Advanced case of granuloma with rectovaginal fistula. Three pregnancies, all terminated by cesarean section.

Smears are but little contaminated by organisms usually present in other vulva lesions.

Small has made a number of cultural studies of the organisms and has reported them in *The Journal of Infectious Diseases*, Vol. 32, June, 1923, and in *Surgery, Gynecology and Obstetrics*, June, 1921. Animal and human inoculations have failed to produce the characteristic lesions. The Donovan bodies are universally found in fresh smears in untreated cases and disappear entirely after two or three treatments with tartar emetic.

Biopsy sections when stained show a superficial cellular area on a base of dense hyaline connective tissue. The cellular area is composed of young connective tissue, relatively small in amount, many endothelial leucocytes, and a smaller number of polymorphonuclear

neutrophiles. Many leucocytes are also present and an occasional eosinophile. At the margin of the granulation the squamous epithelium of the skin is partially destroyed and replaced. Further out this merges into normal skin, under which, however, the subcutaneous tissues are infiltrated by round cells.

There is a proliferation of squamous epithelium near the edges of the granuloma where finger-like projections extend into the deeper tissues resembling to some extent squamous cell carcinoma. After treatment with antimony dense fibrous tissue replaces, to a large extent, the granulations.

Tartar emetic is a specific in the treatment of this disease. Local treatment and excision are of no value and x-ray, while of some bene-



Fig. 5.—Granuloma involving anal region.

fit, cannot be used sufficiently long to effect a cure. We rely entirely on the intravenous use of tartar emetic and local cleanliness. While this drug is a specific it has several disadvantages, which makes its use impossible for a long enough period, in many cases, to effect a permanent cure. One-tenth gram of the drug is dissolved in 10 c.c. of sterile salt solution and given intravenously at weekly intervals in ambulant cases and every other day in hospital cases. The action of the drug is prompt; beginning healing can be observed within forty-eight hours after the first injection. The number of injections required to completely heal the lesion depends on its extent and location. Lesions in the female heal less rapidly than those in the male.

One disadvantage of antimony injections is the tendency to obliterate

ate the veins. For this reason we start the injections into the veins on the back of the hand and then go higher in the arms as the veins below become obliterated. In a few of our cases we have been obliged



Fig. 6.—Granuloma showing appearance of the lesion after treatment with tartar emetic.



Fig. 7.—Photomicrograph of smear taken from granuloma showing Donovan's bodies (after Small).

to discontinue treatment before complete healing had occurred because of obliteration of all available veins. As far as I know no satisfactory intramuscular preparation has been perfected.



The second objection to antimony is the severe rheumatoid joint pains which follow within twenty-four hours after the injection. At times these pains are so severe that patients refuse to continue treatment. A case should not be considered permanently cured just because complete healing has taken place. These cases have a tendency to recur and should have several courses of treatment after the lesion has completely healed. It is practically impossible to keep these patients in the hospital once their lesions are healed and on their discharge they are instructed to report to the clinic for further treatment. This they seldom do until they have a recurrence, when they are again admitted to the wards. They suffer so much from the treatments that they will not return for the injections as long as they are well. Except for these rheumatoid pains we have not observed any serious effects from the use of tartar emetic. Randall observed several cases of kidney insufficiency following its use and realizing the toxic nature of the drug sought an antimonial compound of lesser toxicity. He obtained from Professor J. J. Abel of the Johns Hopkins University two antimonials, sodium antimony thioglycollate and a new synthetic composition the triamide of thioglycollic acid. Cases treated with these two preparations healed as promptly as others in which tartar emetic was used and there was an entire absence of toxic symptoms and rheumatoid pains. Randall has had these two compounds prepared by a prominent pharmaceutical house and is making a study of their therapeutic value.

In conclusion it is to be remembered that inguinal granuloma is endemic in northern latitudes and any vulvar lesions which resist ordinary treatment should be suspected of being granuloma. Antimony is a specific for this disease. The lesions have a tendency to recur and a series of ten intravenous injections should be given after complete healing has been secured.

1530 LOCUST STREET.

(For discussion see page 762.)

## SUPPRESSION OF URINE IN CONNECTION WITH PREGNANCY\*

By JOHN C. HIRST, 2ND, M.D., PHILADELPHIA, PA.

(From the Department of Obstetrics, Hospital of the University of Pennsylvania)

THIS report includes three types of anuria complicating pregnancy and the puerperal state: (1) complete suppression due to kidney degeneration, sometimes spoken of as "idiopathic anuria"; (2) suppression due to urinary calculus, and (3) that due to ureteral edema or pressure.

The first example is that of a woman who lived for nine days with complete anuria following the birth of a stillborn fetus at seven and one-half months.

CASE 1.—Mrs. E. R., aged thirty, was admitted to the University Maternity April 27, two days after an easy spontaneous stillbirth. There is no accurate information concerning the cause of the fetal death, or the duration of the retention in utero of the dead baby, but there are the facts that the patient had been well during this pregnancy, had never shown evidence of kidney impairment or of any other serious illness beforehand, and that she had previously given birth to one healthy child.

The bladder had been found empty before and after sweats, enteroclysis, and purgation at home. Our examination on admission showed a well-appearing woman, with normal temperature, pulse, and respiration, but considerable abdominal distention. The pelvic organs were in average postpartum condition, the bladder containing one dram of ammoniacal urine that showed no albumin and no casts, but many white blood cells. Blood pressure was 110/70.

On April 28 distention was less marked. The patient had no eye symptoms, no headache, no loin pain, and her mind was clear. Cystoscopic examination showed the bladder normal, ureters not obstructed, and no urine at all. Blood pressure, 115/80.

April 29. Blood urea nitrogen 106 mg., and creatinine 7.9 mg. Blood count showed 1,780,000 red cells; 17,400 white cells; hemoglobin, 35 per cent; polynuclears, 78 per cent; lymphocytes 18 per cent, and large mononuclears, 4 per cent.

Wassermann negative. Ophthalmoscopic examination by Dr. de Schweinitz showed only a fine hazy retinal edema. Pyelogram made with 12 per cent sodium iodide solution revealed a normal kidney pelvis and ureter on each side.

May 1. After occasional vomiting, slight headache, dimness of vision, urinary odor, and persistent anuria, bilateral decapsulation of each kidney under gas by Edebohl's method was performed as a last resort. At operation each kidney was found slightly enlarged, pale, mottled, and friable. Immediate recovery was good and the patient passed two ounces of bloody urine in the first twelve hours. The day following, greater pallor of the optic discs was present. Patient was drowsy, blood pressure, 120/80. Amyl nitrite was given for possible spasm of the renal artery, since the usual uraemic remedies had failed. The patient developed convulsions and died May 3, having excreted only nine ounces of urine in nine days.

\*Read at a meeting of the Philadelphia Obstetrical Society, January 7, 1926.

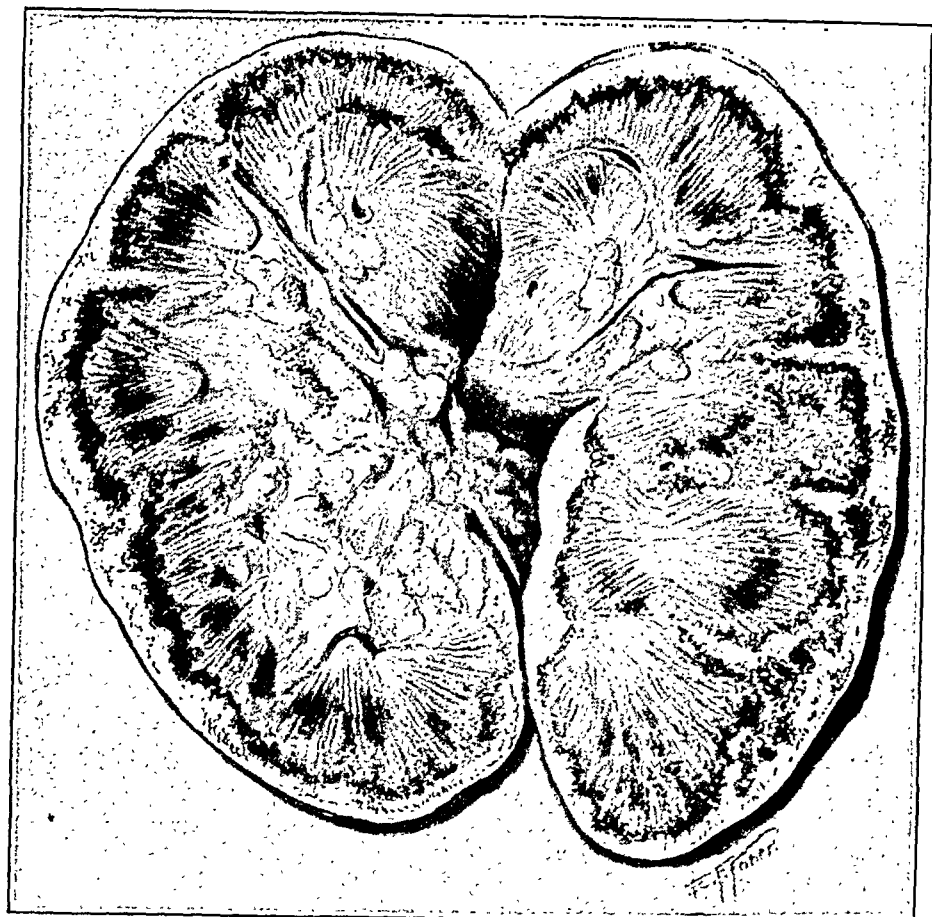


Fig. 1.—Case 1; suppression of urine for nine days from kidney degeneration. (Note cortical necrosis.)



Fig. 2.—Low power section of kidney from Case 1.

The kidneys were removed for examination. No mercury or bacteria in Gram-Weigert section was found. The pathologic report was as follows: "A very definite degenerative nephritis involving the convoluted tubules even to total destruction of nuclei. Many glomeruli show cellular increase, thrombosis and detritus

within the capsule, and a few show fibrin thrombi. Some of the smaller vessels are thrombotic; this kidney seems to present a bacterial and toxic nephritis of recent origin."

The causes of nonobstructive suppression of urine in order of frequency are: First, severe late gestational toxemia with or without underlying nephritis. This is not a complete suppression, but has been treated by decapsulation of the kidneys even recently;<sup>1, 2</sup> B. C. Hirst states that it is due to an exacerbation of a chronic nephritis,<sup>3</sup> and usually is fatal.

Second: Chemical poisoning is usually mercury, occasionally phosphorus. Since mercurochrome has been extensively used for puerperal sepsis, we see relative anuria sometimes. Attention has been called to this feature by A. V. St. George, of Bellevue Hospital,<sup>4</sup> who mentions severe mercury nephritic lesions in eleven autopsies on women treated with mercurochrome for puerperal sepsis.

Third: Degenerative nephritis. This disease appears to be due to a metabolic poison associated with pregnancy. Rolleston has collected eleven cases, showing symmetrical necrosis of the kidney cortex, of which cases most were associated with stillborn premature babies. Berkely and Bonney<sup>5</sup> agree with Rolleston, and state that the condition in no way resembles eclampsia. Boquel<sup>6</sup> and Jardine and Kennedy<sup>7</sup> also believe that a toxic process is responsible as it appears to be in our case. It is possible that products from the dead fetus may injure the kidneys, and if so the early diagnosis of death of the fetus in the uterus becomes more important.

Unfortunately the cultures from the bladder of our patient were lost. Since the course of the disease was afebrile it is probable that bacterial activity was secondary, and that the process in the kidney was mainly a recent toxic degenerative nephritis.

The second example of suppression of urine is that of a patient who presented complete anuria for four days from urinary calculi on one side and ureteral edema on the other, and recovered with surgical treatment.

CASE 2.—*Mrs. T. B.*, aged twenty-four, para ii, past history unimportant. First admission 9/5/25 to 9/17/25, with a complaint of severe right-sided pain, of three days' duration, starting in the lumbar region and radiating to the right groin and leg. Pain was constant except for frequent exacerbations and was accompanied by vomiting. No other complaints except polyuria. Examination showed pregnancy at about the sixth month and considerable tenderness in the right lumbar region and right lower abdomen. Temperature 104°. Urine showed a light cloud of albumin, many pus cells, and a few red cells.

Following routine treatment for pyelitis, cystoscopy was done six days after admission and after three days of normal temperature. An obstruction to the passage of the catheter was found in the right ureter about 5 cm. from the bladder. With the catheter in place an x-ray picture was made, which showed a small shadow lying next to the catheter. The patient being free from fever and symptoms at this time, she signed for release without obtaining further treatment.

Second admission: 10/13/25 to 12/30/25. Readmitted with a history of having had two attacks resembling ureteral colic accompanied by vomiting; she was still suffering with the second attack, which began three days previous to admission. The patient had complete anuria for three days. Temperature, 101.4°; pulse, 120;

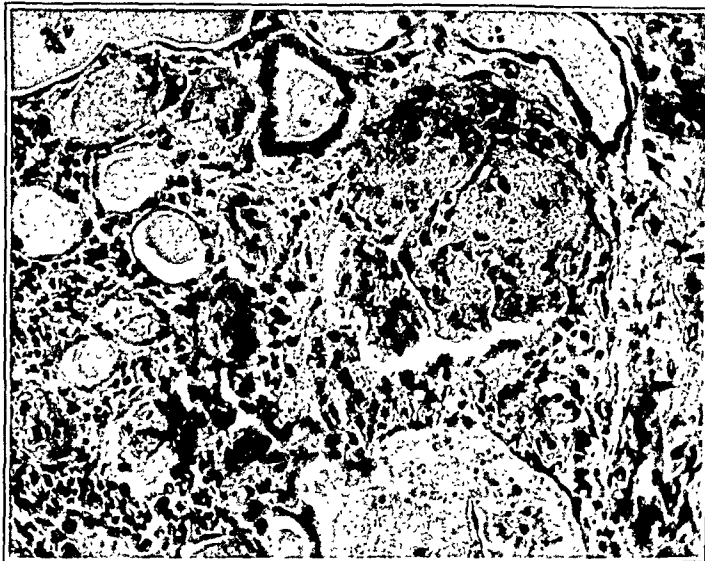


Fig. 3.—High power section of kidney from Case 1.

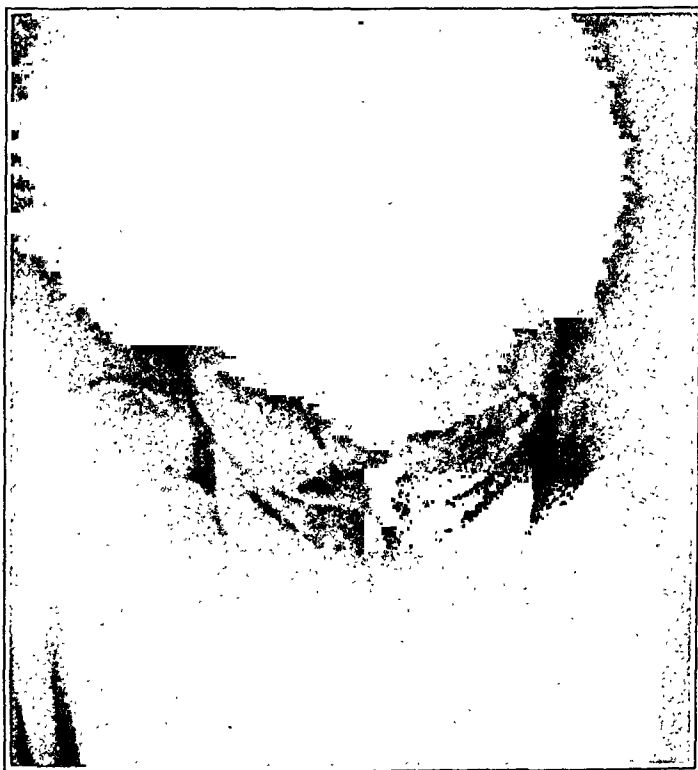


Fig. 4.—Case 2. Pregnant six months. Small stone at tip of catheter.

respiration, 48. Patient was restless and slightly confused. Her skin was dry and hot; her breath was not definitely urinous. General examination was unimportant except for acute deep tenderness in both loins. Pregnancy was then at about the seventh month; head was down, and fetal movements were active. Blood pressure,



Fig. 5.—Case 2. After delivery. Large stone in right kidney. Enormous left hydronephrosis, from edema of ureter.

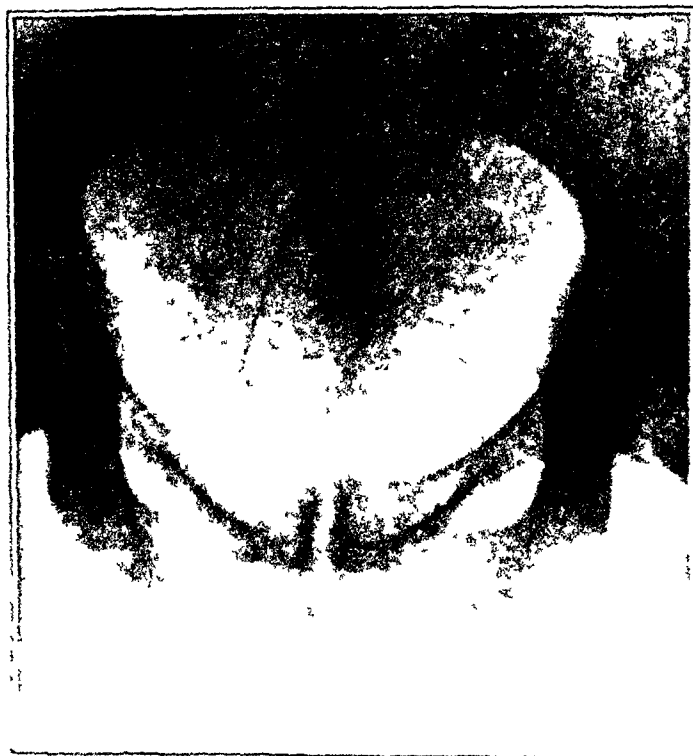


Fig. 6.—Case 2. Three stones in right ureter. (Coincident with stone in right kidney.)

155/90. Leucocyte count, 25,200. Catheterization of bladder yielded no urine. Miscarried the same evening, the child living about three hours.

*Cystoscopy:* Catheterization of the right ureter disclosed an obstruction near the right kidney pelvis, which could be displaced, whereupon purulent urine under pressure gushed from the catheter.

Following this cystoscopy the patient rapidly improved, fever and symptoms subsided, and urinary output increased. Two subsequent cystoscopies were done in the succeeding two weeks, in order to establish and maintain adequate urinary drainage, to complete function studies, and to prepare the patient for lithotomy. In chronologic order, her progress was as follows:



Fig. 7.—Case 2. Stone removed from right kidney.

10/20/25. X-ray shows an enormous left kidney and a large shadow in the right kidney area,—probably renal calculus. In addition there were three small shadows, probably multiple calculi in the lower end of the right ureter.

10/22/25. *Cystoscopy.*—The right ureter did not admit any catheter more than 2 cm. and drained no urine. The left ureter admitted a No. 6 catheter to the kidney pelvis without obstruction, and drained moderately cloudy urine very rapidly. Differential function with indigocarmine appeared at left ureteral orifice in seven minutes; none at right ureteral orifice in fifteen minutes.

10/29/25. *Cystoscopy.*—Right ureteral orifice showed a small grey stone protruding into the bladder. Indwelling catheter was left in each kidney pelvis. Rate of flow on left side was suggestive of hydronephrosis. Urine from the right side was slightly cloudy. Oil was left in the right kidney pelvis. Blood urea nitrogen, 20; uric acid, 4.2.

11/7/25. *Right nephrolithotomy.*—A soft grey stone, about 3 cm. in diameter found in the right kidney pelvis was removed with difficulty, being crushed in the attempt. Lithotomy was performed through Edebohl's paravertebral incision. Wound was packed with plain gauze, and one cigarette drain was inserted.

11/24/25. Patient passed one stone, the size of a pea, by urethra.

12/7/25. Urinary fistula, through lumbar wound. Patient was passing an adequate amount of urine per urethra.

12/11/25. She passed a second stone by urethra.

12/14/25. There was no x-ray evidence of renal, ureteral, or vesical calculus.

12/30/25. Patient discharged in good condition. Urinary fistula closed for past week. Superficial sinus at lower end of lumbar wound.

Final catheterization of ureters showed no obstruction.



Fig. 8.—Case 2. After passage of the three calculi.

*Discussion.*—A review of impacted calculi in the ureter by A. H. Pearce,<sup>4</sup> covering 60 cases not associated with pregnancy, shows that the average time of an impacted stone is nine years, and that 67 per cent of all calculi are in the lower third of the ureter. Staphylococci were present in 47.5 per cent. McCarthy, Killian, and Chase<sup>5</sup> report proof of reflex anuria involving the otherwise healthy ureter, usually associated with calculus on the opposite side. Jeanbran<sup>10</sup> reports the successful recovery of a pregnant woman operated upon for calculus.

The third type of urinary reduction is represented by two very recent cases of eclampsia in the maternity ward of the University Hospital in young primiparae, each associated with recent hydronephrosis. For the past year we have been interested in the study of the kidney of pregnancy from the standpoint of differences in the two kidneys as determined by the cystoscope. We have found that, in addition to



the common mild degree of right side ureteral dilatation, there is at times a difference in the color, specific gravity, and cellular content of the urine of the two kidneys of toxic patients without any evidence of infection. The ureteral disease in the two following cases (Nos. 3 and 4), and the very frequent finding at autopsy of hydronephrosis and hydroureter in eclamptic cases, appear to be justification for our special investigation, which will be reported in the near future, to discover whether hydronephrosis of pregnancy is a cause of certain cases of acute toxemia and eclampsia.

CASE 3.—Mrs. G. S., aged sixteen years, colored, had been married one year. Her menses were normal. Her mother was subject to attacks of petit mal. The patient was admitted to the University Maternity 1/1/26 at 10:30 P.M., with the history of having delivered a full-term child three hours previously after an easy labor. Previous visits to the prenatal clinic at Southeastern Dispensary had disclosed no complications. Her condition was good until about twenty minutes after her delivery, when, during the expression of the placenta, she suddenly complained of violent frontal headache and a moment later had a generalized convulsion, following which she was extremely restless, confused, and had about four more convulsions. On admission she was extremely restless, unmanageable and confused. She was a normally developed, muscular girl. There was no apparent edema. Respirations were somewhat stertorous and accompanied by loud tracheal rhonchi. Blood pressure was 190/120, pulse 116, and temperature 99° by axilla. Her skin was moist. The bladder contained about 4 ounces of urine which boiled solid. During the first hour following her admission she had two convulsions. In the meantime 500 c.c. of blood were withdrawn by phlebotomy and 20 c.c. of 10 per cent magnesium sulphate were introduced into a vein. In addition she was given ½ grain of morphine subcutaneously. The stomach was washed out and three ounces of castor oil were introduced through a stomach tube. Following this she was comparatively quiet. Her blood pressure was 159/80. She was clearly oriented. In view of this and because her skin was actively eliminating, no further treatment by sweating followed at this time. She remained quiet for the next seven hours during which time she had only two slight convulsions.

At the end of this period, however, she suddenly had convulsions with increasing frequency and severity until 11 A.M. of the next day and despite active treatment during this period her convulsions remained uncontrolled. She remained unconscious and finally died during a convulsive seizure. Her treatment during this period consisted of a repetition of the phlebotomy, magnesium sulphate and in addition paraldehyde and normal saline solution. The blood urea nitrogen was 19, uric acid, 11.2.

Postmortem examination 1/2/26. Each kidney was apparently of normal size and position. The right ureter was dilated below the pelvic brim without stricture or stone; the left ureter was normal. Split kidney, left normal, right hydronephrotic; doubtful suggestion of degeneration.

Liver was of normal size; few subcapsular minute hemorrhages. Absence of normal "nutmeg" appearance and apparent early degeneration.

*Histologic studies:* There was not sufficient time for all organs to be sectioned. The right kidney showed severe tubular nephritis.

CASE 4.—Mrs. M. M., aged seventeen, colored, married one year, had a normal menstrual history; her last period was not known. She was admitted to the University Maternity 12/23/25 at 11:50 A.M., in a comatose condition. Pregnancy at about the ninth month. Convulsions had set in suddenly about five hours previously, recurring at frequent intervals until admission, when she was in complete

coma. Breathing was stertorous. Her skin was dry and hot. Temperature,  $98.3^{\circ}$ ; pulse, 108; respiration, 32. There was very moderate edema of the ankles and pre-tibial areas. Blood pressure 175/95. Typical generalized eclamptic convulsions occurred at about fifteen minute intervals. Pregnancy advanced to about the ninth

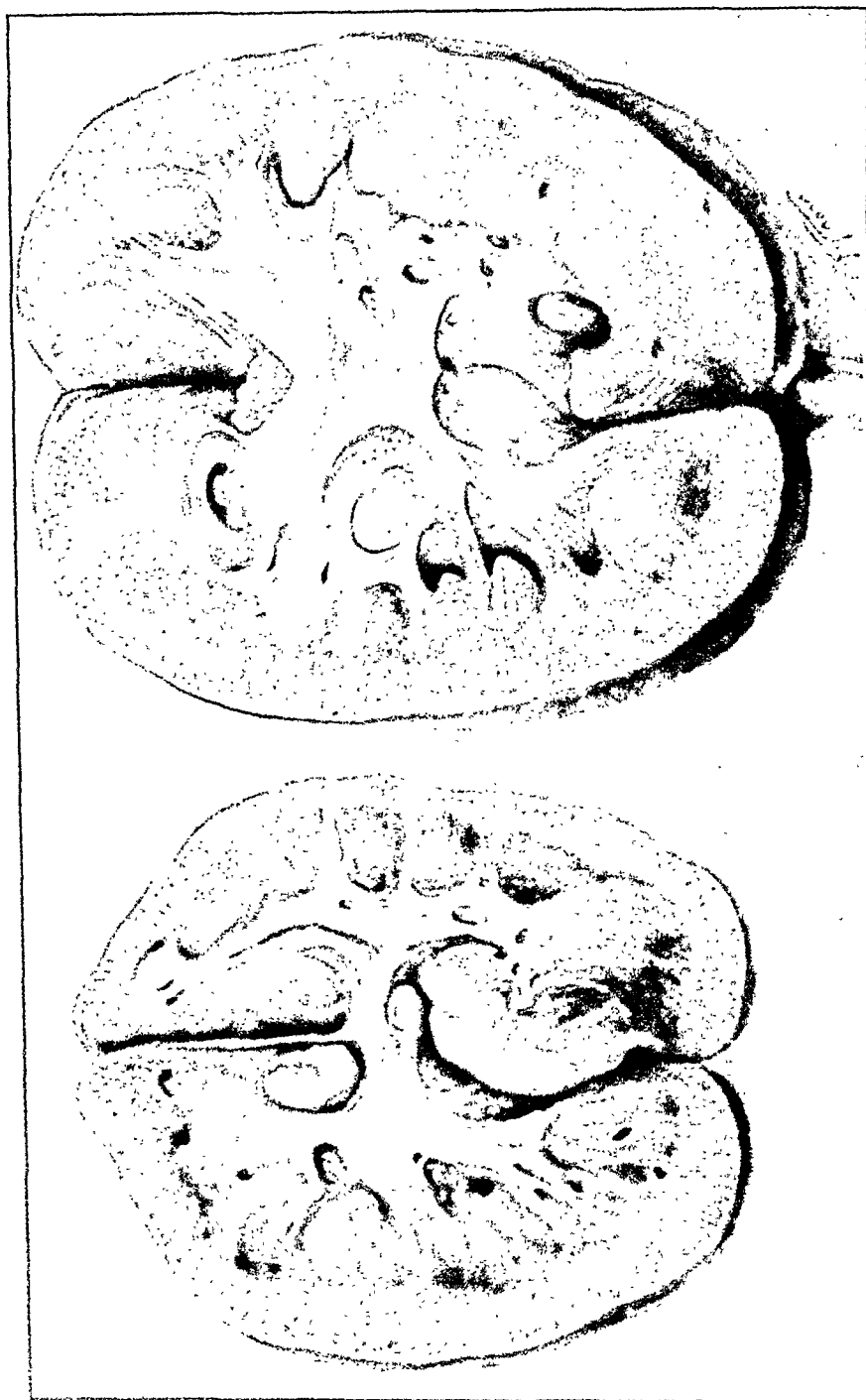


FIG. 5.—Case 2. Eclampsia, associated with hydronephrosis. (Dilatation of right kidney pelvis and ureter.)

ninth, head down, fetal heart not located, uterus tense, cervix closed and uneffaced, pelvis normal. General physical examination was otherwise negative. Twelve ounces of catheterized urine obtained; specific gravity of 1.006. It showed a faint trace of albumin and no casts. Blood urea nitrogen, 11 mg. per 100 cc.

Patient was put upon an active regimen of elimination and sedatives, including gastric and colonic lavage, venesection, morphia, and 50 c.c. of 10 per cent magnesium sulphate in vein. By an oversight the patient was allowed to remain in one of her vapor baths for almost three-quarters of an hour, the nurse in attendance having carried out orders to the letter in allowing her to remain until the skin showed perspiration. The skin was found to be inactive, but the pulse had meanwhile risen to 156, and the blood pressure to 185/110. In spite of this rather active program, the patient continued to have convulsions, a total of twenty being registered in the first six hours after her admission.

Following a cesarean section the patient had a few more convulsions, but none after the first six hours. The mental state began to clear immediately. The blood pressure dropped to 130, at which point it remained for the next forty-six hours. The pulse remained at a high level, however, seldom dropping below 120. The urinary output in the first twenty-four hours was only 180 c.c. despite a good intake, and the peripheral edema did not appear to be taken up by her circulation. In the second twenty-four hours the urinary output increased to 900 c.c., but her pulse remained persistently high, and at the end of forty-six hours began to fail. She died forty-nine hours following operation.

After operation the blood count showed 5,900 white cells, hemoglobin, 60. The specific gravity of the urine was 1.012; it contained a heavy trace of albumin and hyaline and light granular casts. Blood urea nitrogen, 19; uric acid, 7.6.

*Autopsy report:* Double hydronephrosis (moderate) and hydroureter. Each kidney was extremely pale, showing slight yellowish tinge at cortex.

A very inaccurate table of average individual urinary output of the last fifty normal deliveries in the University Maternity without measuring intake, is as follows:

First day -----	29.7 oz.
Second day -----	37.4 oz.
Third day -----	34.7 oz.
Fourth day -----	35.3 oz.
Fifth day -----	36.2 oz.

DeLee states that the amount of urine for the first eight days is 300 to 400 c.c. more than in the nonpregnant woman. Two of the above fifty cases passed less than 20 ounces of urine in the first day; therefore, it is important to instruct nurses of the necessity of keeping accurate record of urinary output at least until lactation begins.

On the pathology of hydronephrosis, H. P. Winsbury White<sup>11</sup> gives the following causes, from a study of 159 cases: Congenital, often associated with spina bifida and imperforate anus, and including horseshoe and ectopic kidney; inflammations; stricture; stone; pregnancy; abnormal renal vessels. In addition we would like to add that due to uterine fibroid, as seen in a case at the Philadelphia Hospital. Also, in addition to the urinary reduction from incarcerated retro-displaced pregnant uterus and impacted fetal head, we wish to mention ureteral obstruction plus hematuria resulting from lateral sacculation of a pregnant uterus due to dense pelvic adhesions following myomectomy.

In conclusion, we wish to call particular attention to chronic pelvic passive congestion in pregnancy resulting in ureteral edema, to point out the necessity of proper regulations for the prevention of this difficulty, and to show the usefulness of the cystoscope in the diagnosis and treatment.

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## INFARCTS OF THE PLACENTA: A STUDY OF SEVEN HUNDRED CONSECUTIVE PLACENTAS

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THE frequent occurrence of areas of so-called infarction has been repeatedly recognized by those who have examined a large number of placentas. Yet, a study of the literature must impress one with the fact that, even in recent times, there has been a wide divergence of opinion in regard to the nature, incidence, and significance of these masses. With this in mind we undertook certain studies of a series of placentas in an effort to throw more light upon the following points regarding infarcts:

1. Structure and materials entering into their formation.
2. Morphologic types.
3. Nature and etiology.
4. Incidence in normal and abnormal pregnancy.
5. Clinical significance.

The material and method of examination were as follows: Seven hundred placentas from consecutive deliveries, the majority at term and none before the eighth lunar month of pregnancy, were inspected, weighed, and measured. They were then hardened in 10 per cent formalin solution (4 per cent formaldehyde) for three to eight weeks, and cut in slices five to eight millimeters thick. Objects five millimeters or more in diameter, and suggestive of infarcts, were described

and later examined microscopically. Certain special studies were also made.

Four, more or less distinct, anatomic types of lesions were found deep in the placental tissue. Infarcts appearing on the fetal surface, including the marginata and margo varieties, were noted when at

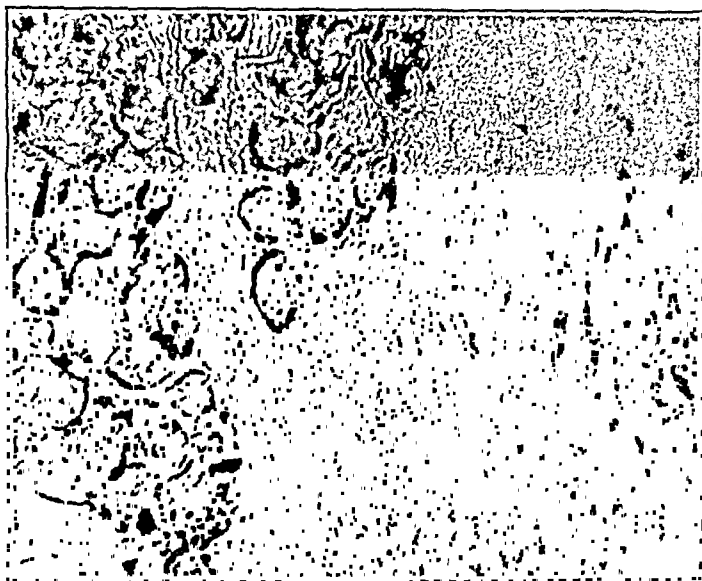


Fig. 1.—Infarct of our second kind (on right) laid down against an old infarct of the fourth kind (on left).



Fig. 2.—Part of the free margin of the same infarct of the second type shown in Fig. 1, showing very little involvement of villi. Note the laminated, thrombus-like appearance of the infarct.

least five millimeters thick. These structures usually belonged in our third group, although a few were of the first and second types, and were situated against the under surface of the thin chorionic membrane. Infarcts showing on the maternal surface were of all four kinds.

The nomenclature of these areas is in considerable confusion since many writers have objected, with some reason, to the old name of infaret and have suggested others as more suitable. We shall devote some discussion to this point under the different headings, but it may be stated here that we do not believe that an appropriate name



FIG. 3.—From the margin of an infarct of the fourth type, showing degenerated villi above and normal villi below. There is less fibrin than usual between the villi of this infarct.



FIG. 4.—Percentage of increased fibrin. The degeneration of the villi resembles that found in infarcts of our fourth type.

for the whole group has yet been suggested and are inclined for the present to use the old and well-established designation, faulty as it is. In regard to the different kinds or varieties of infarcts, the terminology is in such confusion that in lieu of satisfactory names we shall refer to the four types of lesions by number as follows:

1. Infarcts of the first type are poorly defined, or even very irregular, pearl-gray formations occurring usually in the depths of the placenta but at times also near the surfaces and margins. They may vary from a few millimeters to several centimeters in width and occasionally are so large as to extend from surface to surface. We have never seen massive involvement as sometimes occurs in the last type. There are no striations, but there is often a mottled appearance near the outside due to the partial inclusion of small areas of normal placental tissue.

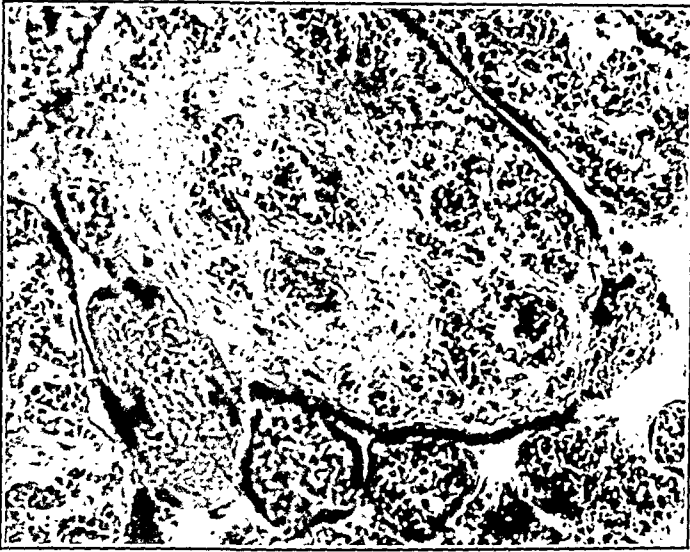


Fig. 5.—A villus showing several breaks in the continuity of the syncytium, with deposits of fibrin. The villous vessels appear normal.



Fig. 6.—Placenta from abortion at the fourth lunar month, showing an early infarct of the first type.

Microscopic examination of an advanced infarct of this kind shows that at the edges there are broad projections of fibrin extending outward to outlying and nearly normal villi, while toward the center the structure becomes solid and consists more and more of degenerated shadows of villi surrounded by old fibrin, fragments of nuclei alone suggesting the original cellular structure. Evidently, the deeper portions are distinctly older, and examples are easily found showing development by

peripheral involvement of villi with fibrin projections from a nucleus of several villi matted together by fibrin.

2. Sharply demarcated, usually rounded or oval bodies, occasionally roughly quadrilateral, varying in diameter from a few millimeters to several centimeters and in color from red, brown, or almost black to pink or brick colored form the second class. The lighter colored masses are striated, often being made up of parallel dark and lighter striae. Infarcts of the second class are frequently surrounded by a distinctly lighter pseudocapsule and may often be found against, or partly surrounded by, infarcts of types 1 or 4. They may be seen singly, or in great numbers throughout the placenta, but usually deep in the placental tissue and seldom near the margins. When large and numerous, the condition has been called *placenta truffée*.

Microscopically, these infarcts are found to be composed of lamellae of fibrin and coagulated blood. Their color depends upon the number and state of preservation of the blood cells, the darker bodies and the dark streaks in the lighter showing densely packed and apparently unchanged red corpuscles. Sections taken at dif-

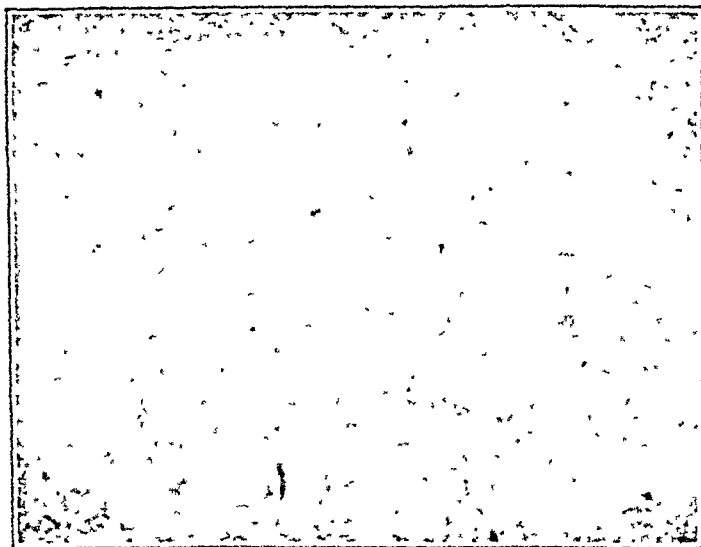


FIG. 7.—An infarct of the fourth type, showing a large branching villus which appears to be the stem for the villi involved in the infarct.

ferent levels show such an infarct always to be against, and in some instances partially surrounded by, a definitely older degenerative formation, usually an infarct of the fourth type, parallel to which the lamellae are laid down (Fig. 1). The rest of the circumference, as well as the deeper portion, shows practically no involvement of villi (Fig. 2). The fibrin on the free part of the periphery is frequently nearly devoid of blood cells, thus explaining the nature of the lighter colored pseudocapsule. In general, these infarcts bear a striking resemblance to fresh intravascular thrombi.

3. In the third group are striated bodies which so resemble those of the second kind in every respect, except color, that perhaps they should be included in that group. They are glaucous or dull white, pinkish or definitely pink or brick colored as a whole or in streaks. In fact, infarcts of intermediate shades, with typical examples of the second and third group, are often found in the same placenta.

Microscopically they are found to be composed essentially of lamellae of fibrin. In infarcts of a pale color there are a few fragmented or degenerating and pale red blood cells between the lamellae. In accord with the darker gross appearance of



other of these bodies, the red cells may be present in such numbers that the infarcts are obviously intermediate forms between the second and third types.

4. Round, oval, or pyramidal bodies usually found near the margin, less often deep in the placental tissue, sometimes near the maternal surface, seldom near the fetal surface constitute the last group. They vary in size from nodules a few millimeters in diameter to masses involving one or several cotyledons. We have once seen approximately one-fourth of a placenta thus infarcted, and on another occasion the entire substance of a succenturiate lobe. Older infarcts of this kind are usually a uniform dull white or light yellow, and the edges, though often appearing slightly uneven or fuzzy, are sharply contrasted with the surrounding placental tissue. The younger forms, as occasionally seen, are pink or even dark reddish brown and are usually mottled. Frequently, these infarcts are found against those of the second and third types (Fig. 1).

Microscopically, these bodies are seen to be composed of closely packed villi with, usually, a thin layer of fibrin between (Figs. 1, 3, and 7). It is characteristic of these infarcts that all the villi in each have reached about the same degree of degeneration. In the more recent forms there is likely to be very little or no fibrin, and the villous vessels are filled, or even widely distended, with apparently normal blood, while the syncytial epithelium appears normal. However, the villous stroma cells stain lightly and are poorly defined, while the nuclei are pyknotic and shrunken. The periphery, at this stage, is somewhat irregular but quite definite, due to the sharply different appearance of the normal and infarcted villi, there being no intermediate forms (Fig. 3). In the advanced stages the blood cells in the villous vessels are faded and disintegrated, while the stroma has lost all evidence of its cellular structure except for a few fragmented nuclei. The syncytial epithelial covering persists longer, at first seeming even to proliferate, but eventually it too degenerates, and finally, there is the picture of structureless but still distinctly outlined villi. The periphery in the old forms is often marked off by a narrow zone of infarction of the first type, or it may be against a body of the second or third kind.

Besides these so-called infarcts, certain other bodies were found. Cysts of the chorionic trophoblast were common, as were also small masses of degenerated trophoblastic cells. The latter occasionally seemed to have served as the starting point for infarcts of the first, second, and third types, but otherwise were of no importance. Occasional angiofibromas were found, but they had no relation to infarct formation. Of frequent occurrence were small, irregular areas of dark blood, some gelatinous in consistency, which upon microscopic examination resembled structureless blood clots, with normal villi irregularly surrounding and dipping into them. In many instances the blood cells had settled toward one side. Although McNalley and Dieckmann speak of these as a type of infarct, we believe them to be only blood which has coagulated between the villi after delivery. In sections taken from fresh placentas they are rarely present. Such is also the case with certain small, empty, round or oval cavities, without capsule and bounded by normal villi, which are probably due to bubbles of air, or perhaps gases from bacterial activity before fixation was complete.

#### NATURE AND ETIOLOGY OF INFARCTS OF THE PLACENTA

In this study we have confined direct reference to the literature principally to that of the last twenty-six years, since J. Whitridge Williams thoroughly covered the ground up to 1900. We have also consulted more recent reviews of the older literature by Giese, Kalina, Clemenz, Strachan, and others. It now seems established that placental infarcts are composed essentially of chorionic villi and maternal

blood. It is, however, to be noted that in 1908 Brindeau and Nattan-Larrier expressed the belief that in eclampsia there could be found infarcts formed from fetal blood which had escaped into the intervillous spaces by rupture of the villous capillaries. Some authors admit that a small amount of degenerated decidua may sometimes be included in infarcts, especially in those at the margin, but none agree any longer with Steffeeck that degenerated decidua forms the basis of placental infarction. Work along embryologic and histologic lines has given fairly conclusive evidence that "decidual islands" and "septa," as well as the top layers of the retroplacental decidua, are really composed of fetal trophoblast or its degeneration products, though opinion to the contrary is still held by McNalley. In any event, it may be safely assumed that the principal constituents of placental infarcts are degenerated villi and maternal blood elements.

The varying proportions and state of preservation of the materials in infarcts account in large part for the differences in gross appearance. Histologically there are other characteristics which probably have some significance in regard to the formation and development. Consequently, the types will be considered separately, though it is true that some of the masses are apparently made up of a combination of the various kinds of infarcts.

*Type 1.*—Infarcts of this kind have received considerable attention, and the consensus of recent opinion is that they are the product of the coagulation of maternal blood elements (mainly fibrin) with the involvement of adjacent villi. Schickelé has suggested the name "fibrin nodule" and Clemenz "white necrosis" as more appropriate. Certainly, strictly speaking, these bodies are not infarcts. Although the idea is not entirely of recent origin, Hitschmann and Lindenthal, Schickelé, Kalima, Clemenz, and others have emphasized that their formation depends upon the same conditions as does intravascular thrombosis, namely, exposure of tissue by loss or degeneration of its antieagulative covering, and a slow blood stream. The placental space with the villi dipping down is looked upon as a blood vessel, the trophoblastic synechia serving the same function here as endothelium in blood vessels.

The relative importance of the two factors is still a matter of debate. Indeed, there are those who contend that one, or the other, alone is responsible for the initiation of the lesions. From the evidence at hand, we are inclined to believe that either condition may be the cause of these infarcts, but that in most instances both factors play a part, or, at least, are present in the placenta near term.

Huguenin is one of the many authors who emphasize the importance of areas favoring coagulation. He lists the tissues which, when exposed, would cause deposits from the blood as chorionic connective tissue, cells of the Langhans layer, fibrin, decidual cells, and already

deposited blood materials. Obviously, the last material may only be present secondarily. Hitschmann and Lindenthal, and others before them, deny that the decidua has any place in infarct formation. Perhaps the older references to decidual cells were to what we now believe to be the fetal cells in the so-called "decidual islands" and top layers of the decidua. Chorionic connective tissue and Langhans' cells may sometimes be exposed by the loss of the syncytial covering, but usually in such event these tissues have already undergone more or less degeneration with the formation of a layer of fibrin-like material. Langhans, and later Biland, described this fibrin layer beneath the chorionic membrane and attributed its formation to degeneration of Langhans' epithelium cells. It is also found on the decidual surface and in the position formerly occupied by the Langhans' epithelium of the villi. It is ordinarily considered, when exposed by the loss of the syncytial covering, to be the basis for deposits of maternal blood fibrin. Langhans noted an association of the fibrin layer formation with syncytial degeneration, and since his time considerable work has been done to determine which process takes place first, and also whether there is a causal relationship.

Ackermann, Eden, and Williams (1900) believed obliterative endarteritis in the villi, and frequently periarteritis, resulting in coagulation necrosis of the portions of the villi just beneath the syncytium, to be the first step. The syncytium, though probably partially dependent on the maternal blood for nourishment, was thought to degenerate subsequently, perhaps as a result of suspension of its function of exchange (Williams, 1900). The vessel changes were found by Williams (1900) to be most marked in the medium-sized villi. Eden believed them to be an evidence of senility of the organ. He found them more frequently at the periphery, comparatively few of the branches being involved. He furthermore stated that he could differentiate such changes from the ordinary postpartum contraction of villous arteries. Certain extreme instances of obliterative endarteritis of villous vessels, but without much apparent relationship to infarction, have been reported (Von Franqué, Rielander, Müller). Fraser, moreover, believes that his work on injection of placental vessels confirms the hypothesis of Ackermann, Eden, and Williams.

This view has been vigorously challenged. In fact, Hitschmann and Lindenthal, Clemenz, Giese, and others denied that they had ever seen such arterial changes. Schickelé stated that to him the picture of arteritis in the villi was not clear-cut, and that certainly there was no such association with necrosis in the placenta. Huguenin pointed out the similarity of the villous arteries to those of the cord and believed the appearance of both to be due to postpartum cessation of circulation.

Hitschmann and Lindenthal, Clemenz, Young, Strachan, McNalley,

and others contend further that the villous epithelium and at least part of the stroma are dependent on the maternal blood for nourishment; and that, therefore, degeneration of the villous epithelium would not result from disturbance of blood supply in the villous vessels, even should this occur. Evidence upon which their opinion is based may be summarized as follows:

1. In young ova before fetal vessels are formed the villi grow rapidly, apparently being nourished directly by the maternal blood.

2. In hydatid mole the villi grow rapidly after death of the fetus and there is no trace of fetal vessels. The same is true of chorioepithelioma.

3. Young reports an instance of tubal pregnancy showing degeneration of the villous trunks but with good preservation of villous tips near the tube wall where the maternal circulation was unimpaired.

4. In syphilitic placentas, with the villous vessels few in number or even entirely absent, there is little more infarction than in the normal organ.

5. The placental villi develop over the decidua basalis; while elsewhere the villi degenerate as the growth of the ovum thins out the reflexa and thus reduces its maternal blood supply.

6. Villi may be deported through the maternal veins and remain in distant organs for some time without change in their structure.

When this evidence is examined, it is found far from convincing. In the first place, in early pregnancy not only the villi but also the embryo grow rapidly, although the latter is not bathed by maternal blood. Obviously, conditions are not the same as during the latter part of pregnancy. The fact that the placenta forms over the basalis does not necessarily mean that villi are nourished directly by maternal blood but rather that they reach their full functional development at the point where most nourishment may be obtained. Hydatid mole and chorioepithelioma are now known to arise as abnormal growths of the chorionic epithelium. In the mole there is degeneration of the stroma. Both give a tumor picture in no way resembling normal villi. Hitschmann and Lindenthal presented the evidence in regard to the frequent normal appearance of deported villi, but in another part of their paper they refer to the opinion of Weigert and Cohnheim that cell death is not immediately evident microscopically, and that the changes usually ascribed to death really take place subsequently. And Young states that dead villi do not become evident as infarcts for ten or eleven days. In regard to the third argument, we cannot express a definite opinion for early pregnancy, but in placentas from late pregnancy the villi soon show evidences of degeneration, often within a few days after fetal death. This is true even when the intervillous spaces are open, and it may be taken for granted that circulation of maternal blood has continued (Fig. 4). We can present no objection to the evidence under the fifth division except to cite the opinion of Huguenin that syphilis does lead to increased infarction, though he thinks the cause is not the arteritis but rather

the difficulty in exchange, due to the increased stroma, which finally leads to functional atrophy of the syncytium. None of the placentas in our series showed syphilitic changes.

On the other hand, there are certain reasons for believing that chorionic tissue may be nourished through the fetal circulation. Müller described three placentas showing extreme dilatation of the capillaries and beginning degeneration of the villous branches in association with arteritis and thrombosis of larger villous vessels. In one case the thrombosis was the result of inflammation, but in the others the cause was not clear. Of greater importance, we believe, are the reports of certain placental tumors. Goodhart and Calderini described two large angiofibromas of the chorion which were connected to the placenta by vascular pedicles but were not attached to the decidua. Margeson found a tumor mass 10 by 6 by 3 centimeters lying in the membranes, and thus separated from the uterus, which as its only attachment had a six centimeter vascular pedicle to the placenta. We have seen two chorioangiofibromas consisting of lobes so tightly pressed together that no maternal blood could have flowed between, and yet, syncytial investment of the lobes, though nourished as it must have been through the fetal circulation, was perfectly preserved. Certainly, this is indisputable evidence that, under some circumstances, at least, tissues of chorionic origin can be nourished by the fetal circulation alone.

Recently, many authors have considered the thinning, degeneration, and final loss of the syncytium (and also the consequent fibrin deposition) as primarily physiologic and probably as an evidence of senility of the placenta (Clemenz, Hitschmann and Lindenthal, and others). Huguenin thinks that expansive growth of the villi causes thinning of the syncytium and breaks in its continuity, which act as the initial points for the deposition of fibrin. Certainly, as pointed out by Kalima, many small villi can be found with breaks in the syncytium and secondary fibrin deposits, but with apparently normal vessels (Fig. 5). No explanation has been offered for this same finding, which is frequent, in early placentas (Fig. 6).

As stated before, the other usually accepted factor in infarct formation is the slowness of the maternal blood stream between the villi. Although Huguenin, Biland, and Kalima contend that deposition of fibrin cannot take place without a break in the continuity of the syncytium, Clemenz and others, though believing that both factors are usually active, point to certain instances of intervillous thrombosis without any evidence of damage to the syncytium of the involved villi. Giese held the extreme view that stasis in the maternal blood stream was always the primary factor, and that degeneration of the syncytium was consequent upon this. Young has been supported by McNalley in his opinion that infarcts are due to a local disturbance in the circulation of maternal blood. This presupposes that there is not a general circulation of

maternal blood through the placenta, but that groups of villi are dependent on more or less isolated systems, demarcated probably by "decidual septa." This is in accord with Bumm's hypothesis, which, however, has been convincingly contested by Kermauner and Wielech. We found no septa of any size at the placental site of a uterus with placenta in situ, which had been removed at the sixth lunar month. Many authors now consider the intervillous placental space to be a sort of lake of maternal blood with a slow current as a result of its greater volume in comparison with that of entering vessels. Toward term this stasis may become more marked by reason of plugging of uterine veins by giant cells (Eden) or deported villi (Giese), or to obliterative changes and thrombosis in the arteries and veins, especially in the presence of toxemia of pregnancy (Rohr from Hirschmann and Lindenthal, Williams [1917], Schwarz and McNalley).

Under special conditions, it has been suggested that there are changes in the blood itself which favor infarct formation. For example, Brindeau and Nattan-Larrier point out that Bar found increased coagulability of the maternal blood in toxemia. Kworostansky believed such a condition to be responsible for increased placental infarction in heart failure as well as in nephritis.

*Type 2.*—As stated under their description, these bodies closely resemble rapidly formed, intravascular thrombi, their structure consisting of layers or lamellae of fibrin in which red and white blood cells, but rarely any villi, are enmeshed. Serial sections show the lamellae at one side to be laid down against definitely older infarcts of the first or fourth types, or degenerated areas beneath the chorion or above the decidua. The infarcts sometimes partly cover or cap the thrombus masses (Fig. 1), but the latter have most of the periphery free (Fig. 2). This part of the periphery often presents a layer of more compact fibrin with few blood cells, thus giving the gross picture of a lighter colored capsule. The presence in these nodules of blood from the fetal vessels (Brindeau and Nattan-Larrier) has not been confirmed. Probably they are formed by rapid coagulation of blood in layers against older degenerated areas, normal villi being pushed back as the masses increase in size. Von Franqué referred to reports by Prochownick, Bumm, and others and also reported two such cases himself as "thrombosis sinum placentae." Huguenin noted their resemblance to thrombi of the heart and great vessels. Haffner objects to the name "infarct" as inappropriate. Nor, should the names hematoma, hemorrhage, or apoplexy (Brindeau and Nattan-Larrier) be used, since these masses are formations in the intervillous placental space, which functions as a blood vessel (Schilling from Von Franqué, Williams, 1923). They should not be confused with retroplacental blood extravasations resulting from premature separation of the placenta or uteroplacental apoplexy, as in our experience the latter are without structure and resemble ordinary blood clots.

*Type 3.*—These bodies are identical in structure to those of the second group, except for a much less number, or even an entire absence, of blood cells between the fibrinous lamellae. Haffner considered them in the same class with the darker structures, ascribing the difference in color to a varying content of red blood cells. Brindeau and Nattan-Larrier noted that the older masses were lighter in color. Several authors have pointed out that newly infarcted areas corresponding to our first type included varying numbers of blood cells which later faded and disappeared (Kalima). McNalley and Dieckmann think that, similarly, degeneration of blood cells in the dark striated bodies results in the lighter ones. We have confirmed their findings in regard to the frequent existence of what appear to be intermediate forms between the dark and the white masses. Sometimes this transition may be apparent in the different parts of the same thrombus.

*Type 4.*—Ordinarily, these infarcts, especially the older ones, have not been differentiated from those of the first group. However, Eden noted their distinctive structure and speculated as to their origin. He spoke of them as nonfibrinous infarcts. Williams described these bodies, and Brindeau and Nattan-Larrier saw them against infarcts similar to our second kind. Young called the early ones "red infarcts" but noted that they faded later, the old ones becoming white.

Eden supposed the development of such an infarct to be due to a local failure of the maternal circulation supplying the area of placenta occupied by the infarct. He assumed that, as the pressure of the blood was lowered, it no longer held the villi apart but permitted them to collapse against each other. Young supported this hypothesis and in some cases attributed the disturbance in circulation to retroplacental and intraplacental hemorrhage. However, in at least some of his colored illustrations the infarcts have existed for a sufficient time to become light brown or nearly white, while the hemorrhages are still dark and thus probably are more recent formations. In order to accept Eden's explanation we must assume that the maternal blood circulation in the intervillous spaces is carried on by a number of independent systems, an idea against which Kermauner and Wieloch have presented convincing evidence, as stated above. We have demonstrated by serial sections that younger infarcts of this type may be found deep in the placental tissue and entirely surrounded by apparently unaffected villi. Fig. 3 shows part of the periphery of such an infarct, as does Young's Fig. 4 of Plate II. It is difficult to conceive of a unit of intervillous circulation so circumscribed that its failure can cause necrosis of villi in a well-defined group and not affect those directly adjacent on all sides. Indeed, the fact, noted by others and confirmed by us, that the syncytial investment of the villi persists even after there is demonstrable necrosis of the stroma suggests that the primary disturbance of circulation was in the fetal vessels rather than in the intervillous space.

In connection with the cause of these infarcts it is to be noted that in the younger bodies the villi have undergone about the same degree of degeneration. In general this holds also for the older ones, except that at the periphery there is being formed infarction of the first type, but evidently secondarily. Apparently, then, these infarcts are not built up gradually, but all the villi are affected simultaneously. Also, we have noted several times a large branching villus entering in a manner to suggest that it was the villous stem for all villi in the infarct (Fig. 7). All the tissue that remained of three such infarcts was cut in serial sections without other large villi being found. Only a few sections from infarcts of the first type are required to prove that many villous stems and their terminal branches are involved. Next, as a check, all the tissue of two small infarcts of our fourth kind, one five millimeters in diameter and the other slightly smaller, were cut into serial microscopic sections. In each instance all the branches to which the degenerated terminal villi were attached could be traced to one entering villous stem. All the vessels were thrombosed; but because of the difficulty in identifying such small bodies suitable for serial sections, both infarcts selected were so degenerated that it was impossible to determine definitely whether thrombosis was primary in the smaller villi or in the stem. However, the histologic evidence strongly suggests that these bodies represent instances of true infarction due to a disturbance of the fetal-placental circulation.

#### INCIDENCE AND CLINICAL SIGNIFICANCE

From early times the frequent occurrence of infarcts of the placenta has been noted, but with wide discrepancies in the figures of incidence. Williams (1900) attributed this to differences in methods of examinations and in criteria. He saw microscopic infarcts in all placentas at term and found bodies at least a centimeter in diameter in 63 per cent, including the placenta marginata type. More recently Haffner and Ravenstein, employing methods somewhat comparable to ours, reported an incidence of 42.6 per cent and 72 per cent from 400 and 260 placentas, respectively. Among our 700 consecutive placentas there were 474 or 67.7 per cent with infarcts of some kind measuring at least five millimeters in diameter.

Kalima found slightly more infarcts in placentas from multiparas than in those from primiparas, and attributed the difference to a greater likelihood of the development of stasis in the uterine vessels of multiparas. The percentage incidences in our 700 placentas (Table I) fail to show such a relationship, the differences being so slight as to make their significance questionable. Also, apparently, age has no influence on the development of infarcts.

The older authors considered the presence of albuminuria to be an important factor in infarct formation. Williams (1900) confirmed them



TABLE I  
PERCENTAGE INCIDENCE OF PLACENTAL INFARCTS IN RELATION TO AGE AND PARTY OF PATIENTS

NUMBER OF PLACENTAS	ALL PLACENTAS	YOUNG (UNDER 30 YR.)	OLD (OVER 30 YR.)	PARA I	PARA II	PARA III+	YOUNG PARA I	YOUNG PARA II	OLD PARA II	YOUNG PARA III+	OLD PARA III+
	700	402	298	364	214	122	263	105	109	34	88
Type 1	13.1	13.9	12.1	12.1	15.9	11.5	12.5	17.1	14.7	14.7	10.2
Type 2	25.7	26.9	24.5	24.5	26.6	28.7	25.5	28.6	24.8	32.4	27.3
Type 3	33.9	32.1	36.2	32.1	33.2	40.2	29.7	32.4	33.9	50.0	36.4
Type 4	19.1	19.4	18.8	20.6	17.3	18.0	20.2	17.1	17.4	20.6	17.0
Intact of some type	67.7	66.9	68.8	66.8	67.3	71.3	65.4	67.6	66.9	76.5	69.3

in regard to the relationship of red infarcts (our second type) to nephritic toxemia, but McNalley and Dieckmann found these bodies very frequently also in placentas from normal pregnancy. Kalima held that toxemia of pregnancy caused the formation of large infarcts. Young believed infarcts corresponding to our fourth type to be of importance in the etiology of albuminuria. Haffner, and later Ravenstein, denied that there was any connection between albuminuria and the incidence of infarcts. In our 700 placentas there were 45 from pregnancies complicated by so-called toxemias of pregnancy, as indicated by albuminuria associated with hypertension. Clinically there were 37 cases of preeclamptic toxemia, 5 of eclampsia, and 3 of nephritis. Not only the incidence of all types of infarcts (Table II) but also their size and

TABLE II

PERCENTAGE INCIDENCE OF INFARCTS IN PLACENTAS ASSOCIATED WITH TOXEMIA OF PREGNANCY

	ALL PLACENTAS	PREECLAMPSIA	ECLAMPSIA	NEPHRITIS
Number Placentas	45	37	5	3
Type 1	17.8	18.9	0	33.3
Type 2	31.1	29.7	40	33.3
Type 3	37.8	40.5	20	33.3
Type 4	42.2	40.5	60	33.3
Infarct of some type	86.7	83.8	100	100

TABLE III

PERCENTAGE INCIDENCE OF SMALL AND LARGE OR NUMEROUS INFARCTS

	NORMAL PREGNANCY	PREGNANCY WITH TOXEMIA
Number Placentas	655	45
No infarcts	32.8	13.3
Small infarcts	54.4	60.0
Large or many infarcts	11.75	26.7

number were greater (Table III). Because of the fact that infarcts are found in the majority of placentas from normal pregnancy, and for other obvious reasons, it seems probable that their higher incidence with albuminuria is a consequence rather than a cause, as believed by Young. The increased infarction with the toxemias may be due to intervillous stasis consequent upon the more marked changes in the uterine vessels (Kalima, Schwarz and McNalley).

It has long been held that extensive infarction of the placenta might lead to such a disturbance in circulation as to result in a poorly developed child, and even its premature delivery or death in utero. Fehling believed that toxemia of pregnancy led to extensive infarction which in turn caused the death of the child (Williams, 1900, Kalima). In our series the number of stillbirths (eighteen) does not permit a statistical study of much value in regard to their relationship to the occurrence and size of infarcts. However, it is noteworthy that among

the nine stillbirths, whose cause was debatable, only two were associated with more than a slight infarct formation. Five were associated with toxemia of pregnancy, but in only one instance was there marked infarct formation; hence the inference that marked infarction bears no frequent or distinct relationship to stillbirths, either primarily or secondarily as a result of the presence of toxemia. Nor, if we accept our figures for normal pregnancy, do infarcts of the placenta, even when large, interfere with the growth of the fetus (Table IV). With toxemia,

TABLE IV

AVERAGE WEIGHT IN GRAMS OF BABIES IN RELATION TO INFARCTION OF THE PLACENTA

	NORMAL PREGNANCY	TOXEMIA	TOXEMIA MINUS INDUCED LABOR
Number babies	655	45	41
No infarcts	3305	2865	2865
Small infarcts	3375	2975	3030
Large or many infarcts	3315	2700	2880

on the other hand, the average weight, though reduced in all groups, showed a great reduction for the children associated with large or numerous placental infarcts. However, when babies born after induction of premature labor were eliminated from the calculations, the figures are without much significance (Table IV). Then, in these 700 consecutive deliveries there is little evidence that infarcts of the placenta, even when large, bear any relationship to the welfare of the fetus, either in normal pregnancy or when so-called toxemia of pregnancy exists.

#### SUMMARY

So-called infarcts of the placenta are of four kinds, but are all composed largely of degenerated villi and elements from the maternal blood. In three types the formation resembles intravascular thrombosis and depends upon stasis of the maternal blood flow in the intervillous placental space, and the existence of areas denuded in some way of their anticoagulative syncytial epithelium. The fourth kind probably represents a simultaneous involvement of all the branches of a stem villus due to disturbance in the fetal-placental circulation.

In 700 carefully examined placentas, which were delivered consecutively, there were infarcts of some kind in 67.7 per cent, there being no relationship of occurrence to age or number of pregnancies. All types were more frequent in placentas associated with toxemia of pregnancy, as was also extensive infarction. The presence of infarcts had little or no influence on the welfare of the child.

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## THE CLINICAL SIGNIFICANCE OF THE SEDIMENTATION TEST AS A DIAGNOSTIC AND PROGNOSTIC SIGN\*

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**D**URING the last decade there has been a steady trend toward greater conservatism in the treatment of pelvic infections for, with an increasing knowledge of the physiologic pathology which takes place in these lesions, whether of a gonorrheal, postabortal, or postpartal origin, we recognize more and more, that the patient who recovers does so by a resistance due to her natural forces, i.e., by the production of a leucocytosis, tissue cell proliferation, and the formation of antibodies which overcome the invading organisms in the tissue fluids. Furthermore, it is these body fluids that dispose of the toxins.

Surgical attack is being limited to the drainage of local pus foci and to the removal of the results of these infections when they have reached the quiescent stage. Even here there is a proper and an improper time for intervention.

It is in the hope of adding something to our clinical knowledge, that may help us to determine the presence of latent infections and when to operate and when not to interfere, that we have undertaken this study.

During 1925 and 1926, each patient admitted to the gynecologic wards of the Long Island College Hospital has had repeated sedimentation tests done, in addition to the routine laboratory and clinical data. Hence the significance of the sedimentation rate in almost every gynecologic condition has been checked, grouped, and correlated. The usual preoperative routine includes a detailed history, a complete physical examination, an examination of the urine, study of the blood chemistry, a Wassermann reaction, a hemoglobin estimation, a complete blood and differential count, kidney function tests, temperature, pulse and blood pressure readings.

Even with these data we have at times been unable to determine the presence of latent infections and to prognosticate the postoperative course of patients when operation was to be performed.

It is admitted that a rapid sedimentation time spells infection, but

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it does not necessarily mean that this infection is in the pelvis. It is, however, a danger signal which should be heeded in considering the time for operation, even when temperature and blood count are favorable. Furthermore, it has been shown that the usefulness of the test depends on its *frequent repetition* and its correlation with the other known clinical reactions, as the blood, temperature, and pulse. Therefore, from this study we hope to show:

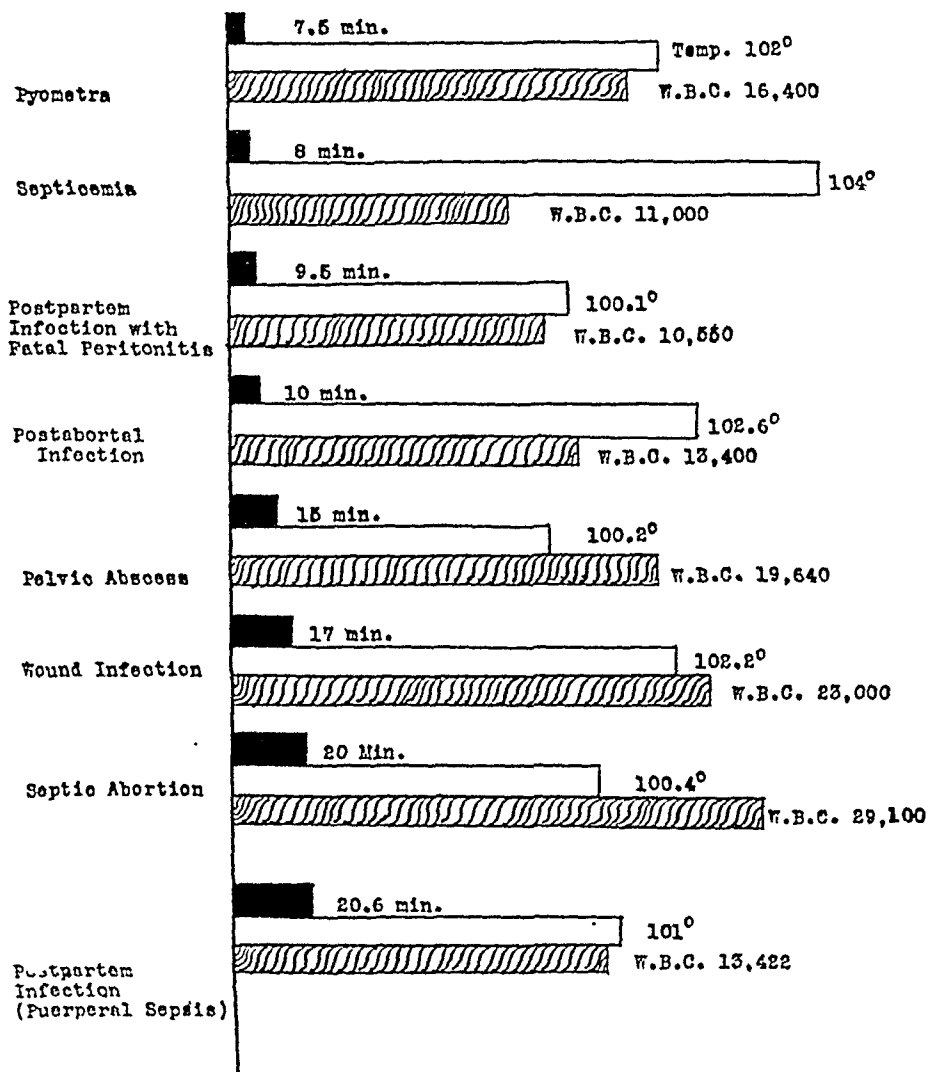


Chart I.—Table showing average sedimentation rates, leucocyte count, and temperature in groups of acute cases.

1. That the sedimentation test when repeated daily, or two or three times a week in any case of pelvic infection, and when considered in conjunction with the pulse rate, temperature curve, and the leucocyte and differential count, is a diagnostic as well as a prognostic sign of great importance.

2. That while a single test may show the presence of infection, it is not a fair index of the potential danger of said infection when the

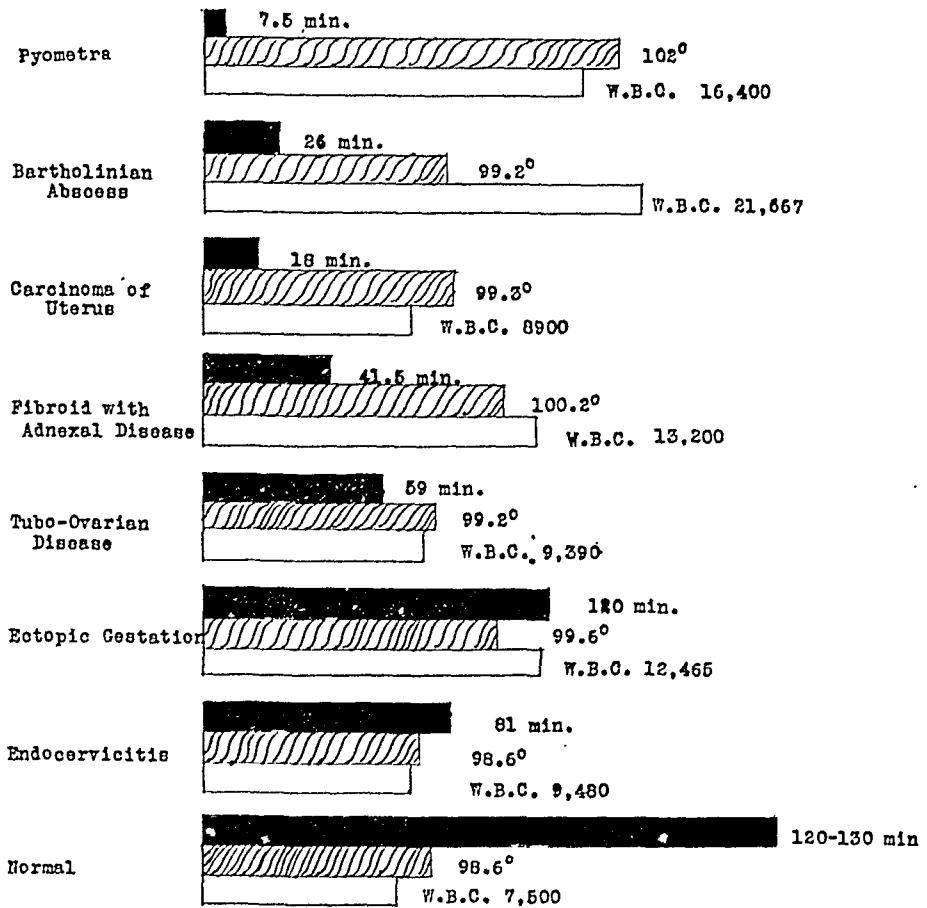


Chart II.—Relation of the average sedimentation time, temperature, and leucocyte count in several groups of cases. Compared with the average normal sedimentation time.

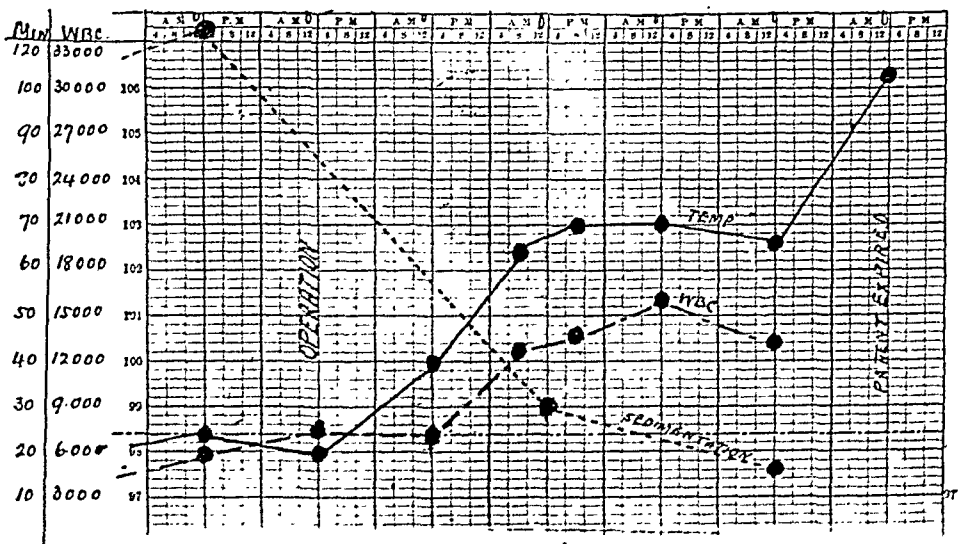


Chart III.—Fatal Peritonitis: This chart reveals a normal sedimentation rate, temperature, and white blood cell count prior to operation. Following operation the temperature began to rise first; the leucocyte began to rise slowly, and the sedimentation rate was very rapid. The sudden drop in rate, together with the increase in temperature, indicates a bad prognosis. In the follow-up of this case it will be noted the temperature became remittent in type varying from 100° to 103° and 106.2° pre-mortem. The sedimentation rate became more rapid, while the leucocyte curve remained at about the same level. From this case, one would be inclined to believe that the sedimentation test was the more sensitive, but we feel that the combination of the three clinical methods gave more information than any one finding.

barriers are disturbed or broken down by manipulation or operative procedure, unless it is repeated and correlated with other clinical data.

*Technic:* All of the tests were done by one person so that there could be but little chance of technical error. The technic employed in this investigation was that of Linzenmeier as modified by Friedlaender. Hard glass tubes 5 mm. in diameter and 6.5 cm. in length with a capacity of more than 1 c.c. were used. The tubes were marked at the 1 c.c. level and at 6, 12, 18, and 24 mm. respectively below. Eight-tenths c.c. of blood was drawn directly from the vein into a Luer tuberculin syringe which contained 0.2 c.c. of a freshly prepared 5 per cent solution of sodium citrate. The blood and citrate solution were shaken until thoroughly mixed. The mixture was then placed in a sedimentation tube and allowed to stand at room temperature. The time was noted when the mixture was placed in the tubes, and observations were made from five minutes and upwards as found necessary. The time was noted when the line of demarkation between the erythrocytes and the plasma reached 6, 12, and 24 mm. respectively. The readings used in this report correspond to the time for the line of demarkation to reach the 18 mm. mark. All suggestions made by Friedlaender and other investigators were closely followed so that the technic was uniform.

Charts have been prepared in which 300 consecutive gynecologic patients are grouped according to the sedimentation rate, temperature, and leucocyte count.

TABLE I

SHOWING A COMPARISON OF THE RATES OF SEDIMENTATION, LEUCOCYTE COUNTS, AND TEMPERATURE IN GROUPS OF SIMPLE AND COMPLICATED FIBROIDS

DIAGNOSIS	NO. CASES	SED.	TEMP.	HGB.	W. B. C.	POLYS
Simple fibroids	26	76	98.6°	72	7400	65
Complicated with asthma	1	36	98.2°	80	8200	56
Complicated with adnexal disease	10	41	100.2°	70	13320	73
Complicated with pyelitis	3	28	98.8°	91	13500	65
Complicated with chronic appendicitis	6	43	98.6°	68	6830	63

Chart I includes patients having a rapid sedimentation rate of less than thirty minutes associated with temperature and leucocytosis, and as a result we find that cases of postpartum infection, postabortal infection, pelvic abscess, wound infection and postpartum infection with peritonitis, fall within this limit.

Chart II includes cases with rapid sedimentation, a moderate leucocyte reaction, and a temperature of under 100°; here we find localized collections of confined purulent material,—as bartholinian abscess, pyelitis, and old pelvic inflammatory masses.

Carcinoma of the uterus has invariably shown a rapid sedimentation time with no corresponding rise in temperature or leucocytosis. In the differential diagnosis between tuboovarian inflammation and ectopic pregnancy, the sedimentation time has been rapid in tuboovarian inflammation and relatively slow, i.e., one hundred minutes or more, in ectopic pregnancy.



One of our most interesting observations has been in a series of 26 uncomplicated fibroids of the uterus in which the sedimentation time averaged seventy-six minutes, while in 10 cases of fibroid complicated with adnexal inflammation the time of sedimentation was only forty-one minutes, this notwithstanding that both temperature curve and white cell count showed no elevation above the normal. (Table I.) This rapid rate has also held true in fibroids complicated with asthma, and fibroids complicated by chronic appendicitis and pyelitis. These observations have definitely demonstrated the value of the test in showing the presence of infective processes whether confined to the pelvis or not. As a prognostic sign it also has a value when correlated with other clinical data as will be shown in Charts III and IV.

It is well established that foci of infection may remain quiescent for weeks, months or years, only to undergo exacerbation after opera-

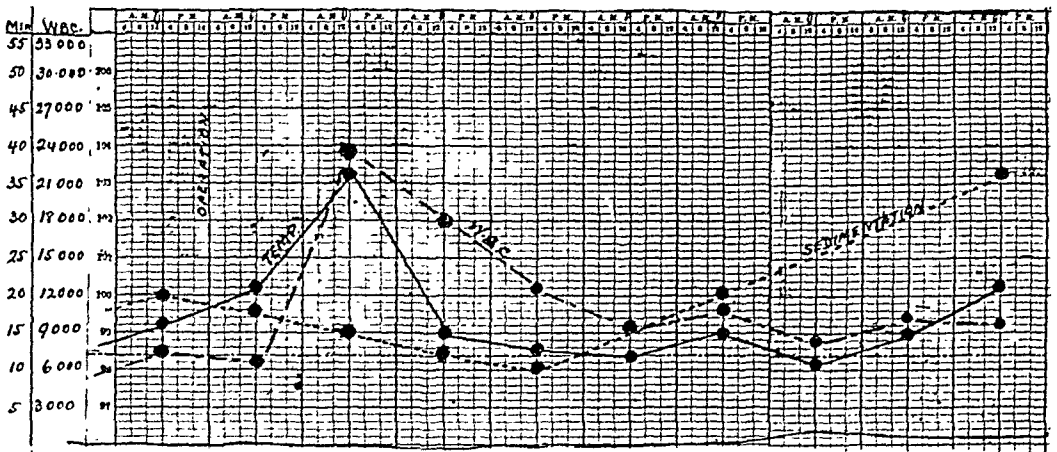


Chart IV.—Incomplete abortion with potential infection (low grade): This chart shows that the patient had a low grade temperature (99°) prior to operation. The leucocyte count was normal, but the sedimentation time was low (twenty minutes). The patient was curetted and on the sixth day following, her temperature rose to 103.2°, leucocyte count 21,800, with fifteen minutes sedimentation time. The prognosis according to these findings was not so good. The following day the temperature came down, the leucocytes were lower, but sedimentation remained about the same. In this case temperature and leucocyte count predicted a much more immediate prognosis than did the sedimentation time. The latter only began to show a gradual rise with the improvement of the patient.

tion, when they may produce peritonitis, parametritis, and blood-stream infections. Apparently the bacteria are buried in the tissues and are surrounded by a limiting wall of connective tissue. Trauma produces dissemination. Heretofore, the clinical history and Simpson's rule have been our only guides. The sedimentation test adds another safeguard. For example: in incomplete potentially septic abortions, appreciation of a rapid sedimentation time when associated with a normal temperature curve and low leucocyte count, has saved a number of women from having their uteri curetted and nature's barriers broken down. Its routine employment as a pre-

operative procedure in gynecologic cases will likewise safeguard the woman who is potentially infected, or warn us of her infectivity when the local barriers are broken down.

TABLE II

ANALYSIS OF THE AVERAGE SEDIMENTATION RATES, TEMPERATURES AND LEUCOCYTE COUNTS IN GROUPS OF ECTOPICS AND TUBOOVARIAN DISEASE

DIAGNOSIS	NO. CASES	SED.	TEMP.	HGB.	W. B. C.	POLYS
Ectopics	10	104.5	99°	75	12,000	70
Tuboovarian disease	16	59	99°	78	9390	66

We have found a low sedimentation time to be the earliest index of beginning postoperative peritonitis or parametritis. We would, therefore, conclude that in the sedimentation test, we have another aid in the diagnosis of infection and that when frequently repeated and correlated with the history, the temperature curve, and the white cell changes, it is a valuable index as to when to operate and a sign of prognostic value.

*(For discussion see page 757.)*

## THE RELATION OF BASAL METABOLISM TO STERILITY\*

(A Preliminary Report)

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IT HAS been known for years that marked disturbances of the function of the thyroid gland cause sterility, but the possibility that the milder alterations of that function may also affect fecundity has been given scant attention. As David Marine says: "The relation of the thyroid to the sex organs is the most ancient and classical interrelation of the functions of the glands of internal secretion, known to the ancients and a subject of daily gossip, it has passed down through the ages." With the hyperfunction of exophthalmic goiter or the hypofunction of myxedema, conception is rare. This preliminary report is chiefly upon a study of sterile woman with a basal metabolic rate only slightly below normal and showing none of the other usual symptoms of myxedema. The milder degrees of hyperthyroidism have not yet been studied.

We have approached the question from two angles: first, what proportion of sterile women have a low basal metabolic rate and can any of them be relieved by treatment, and second, what proportion of women with a low basal metabolic rate are sterile.

Our attention was first directed to this problem by one rather striking case, the principal features of which follow:

Mrs. B., aged twenty-six years, came to me, seeking relief from sterility. Her health had always been good. She was rather a large woman of unusual physical development. The most significant fact in her history was that her menses were always irregular, from three to nine times a year. Examination revealed only an acutely anteфлекed uterus which was corrected by dilatation, not because we have much belief in its efficacy, but because we did not wish to neglect even the remotest possible cause of her sterility. For the same reason, although I have little faith in the clinical value of any of the ovarian extracts, she was given various preparations with the same result that followed the dilatation, namely, failure to conceive and no benefit to her menstruations. Before beginning any of our procedures the husband had been examined and found to be in good health; his semen was normal in every particular.

The patient had no symptom of myxedema, so we did not give her thyroid medication. Having failed in all the usual gynecologic procedures, I suggested a complete general physical examination in spite of the fact that she was the very picture of robust health. She said she would do anything that might make it possible for her to have a baby.

The only abnormality found was a basal metabolic rate of minus seventeen. Beginning in November, 1921, she was given five grains of thyroid extract daily.

\*Presented at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 21 and 22, 1926.

On December 20, 1921, the basal metabolic rate had risen from minus seventeen to plus twenty-three. The dose was reduced and on January 17, 1922, her metabolic rate was normal, plus four. She was told to continue the reduced dosage but did not report until April 6, 1922, when she stated with much discouragement that she had not menstruated since January 5, but to her great joy and our surprise, examination revealed a three months' pregnancy. We did not dare, at that time, to believe that the treatment had anything to do with conception but rather considered it a coincidence. The treatment was continued throughout the pregnancy which terminated normally October 26, 1922.

In September, 1923, the patient came to the office saying that she wanted another baby but was unable to conceive and said that she would like to have her basal metabolic rate taken. The next day her rate was minus thirteen, so little below normal that we thought that her only pregnancy must have been only a coincidence, so far as our treatment was concerned. But, again, without expectation of success we gave her thyroid extract. On March 11, 1924, she came, not discouraged on account of amenorrhea but believing that she was pregnant because she had not menstruated since January 20, 1924. Our examination confirmed her conviction that she was pregnant, and her second baby was born October 26, 1924.

She took two grains of thyroid extract daily throughout this pregnancy and for a month after delivery, when her basal metabolic rate was normal, plus four. She continued to menstruate normally. We were now impressed with fact that two pregnancies had followed thyroid medication in the presence of a moderately low basal metabolic rate and we began our investigation by estimating the basal metabolic rate in other sterile women. But our enthusiasm received something of check when this same patient on December 1, 1925, came in and announced again that she was pregnant, not having menstruated since October 1. She had conceived without thyroid treatment, and we again feared, even though she had twice conceived under the treatment, that it was a coincidence and that her low metabolic rate was not a factor in her sterility, so we made a basal rate estimation the next day and we were a little more sanguine when we found the rate normal, plus eight. So our surmise that a normal rate is necessary to conception was still tenable. But we still wondered why the rate was normal when every previous determination was subnormal except when she was under treatment.

She knew of our quandary and asked if iodized salt which she had been using on her table for some time could account for her normal basal rate. Perhaps it did. The patient aborted December 17, 1925. She was told to discontinue the iodized salt for the purpose of testing its effect upon her basal metabolic rate. On February 7, 1926, her basal rate had dropped to minus three, and on April 27, 1926, to minus fourteen, so I believe that we may safely infer that her normal basal rate at the time of her third conception was in all probability due to the iodized salt.

Perhaps, then, it is not beyond reason to believe that the three pregnancies in this patient were due to the treatment which made her basal metabolic rate normal.

After this woman's second pregnancy we began to think seriously about the possibility of moderately low basal metabolic rates being in some cases a cause of sterility (or the index of a cause). Therefore, in those cases with a history and symptoms pointing to endocrine disturbances we determined the rate, and lately, in practically all sterility cases, the rate has been taken. Our results are presented as this preliminary report.

We have for analysis 69 consecutive cases of sterile women upon whom the basal metabolism rate has been determined. Of these, 44 came seeking relief for sterility; the remaining 25 were found during the course of a complete general physical examination to have a low basal rate and were sterile, but sterility was not the primary reason for their coming for examination. Of the 44 seeking relief from sterility, 22, or 50 per cent, had a basal metabolic rate of minus ten or below. We are following the usual rule of considering the normal rate to be between plus ten and minus ten.

Of these twenty-two, eight had a basal metabolic rate of between minus ten and fifteen; 5 between minus sixteen and minus twenty; 4 between minus twenty-one and twenty-five; 2 between minus twenty-six and thirty, and 1 minus thirty-seven. Of these twenty-two, eighteen received carefully supervised thyroid medication, of whom 6, or  $33\frac{1}{3}$  per cent, became pregnant within a short time after beginning treatment, usually within two months.

One patient, reported above, conceived three times, giving us a total of eight pregnancies, or 40 per cent, following treatment. None of these 6 women had other symptoms of myxedema, not even the woman with a basal metabolic rate of minus thirty-seven, and, excepting this one, none had a rate more than minus twenty, the highest being minus thirteen.

Having obtained these very suggestive results in women coming primarily on account of sterility, this question suggested itself: What proportion of women are sterile who come to the physician with other complaints than sterility for a general physical examination and are found to have a low basal metabolic rate?

In this group were 114 women with low basal metabolism rates, of whom 68 were married. Thirty-one, or 45 per cent, of these women were sterile, including 4 with symptoms of myxedema whom we would expect to be sterile. Omitting these 4, 27, or 39 per cent, were without signs of myxedema, yet they were sterile.

Weight is added to the probability of the low basal metabolism rate being the cause of the sterility by the fact that 40 per cent of the 114 women, both married and unmarried, had functional disturbances of menstruation.

In addition to 31 sterile women, there were 5 others who had no living children but had had one or more pregnancies resulting in abortion, miscarriage or stillbirth, two of the women later carried their babies to full term following treatment. So it appears that a normal basal metabolic rate is apparently not only necessary for conception to occur, but also probably necessary for a continuance of the pregnancy.

Definite conclusions cannot be drawn from this small number of cases, but there is a significance in our findings which demands fur-

ther investigation to establish the truth or falsity of the possibility that moderate or, as it has been called, "incipient" hypothyroidism may be a cause (or the index of a cause) of sterility. To this end we are instituting animal experimentation and are making this preliminary report with the hope that others may continue the study on women who are sterile, and in due time enough evidence may be accumulated to decide the question one way or the other.\*

#### SUMMARY

While the number of cases in this preliminary report are not sufficient to justify drawing final conclusions, the findings are significant because:

1. The relation between the thyroid gland and the ovary is well known.
2. Myxedema is certainly a cause of sterility.
3. Lesser degrees of hypothyroidism are, by the results of our investigation, apparently also a cause (or index of a cause) of sterility.
4. A normal basal metabolism rate is apparently necessary to conception and to a normal continuance of pregnancy.
5. Properly supervised thyroid medication will restore the basal metabolic rate to normal and in some cases result in conception.
6. Women who habitually abort should have their basal metabolic rate taken.

1009 NICOLLET AVENUE.

(For discussion see page 763.)

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\*I wish to acknowledge my indebtedness to my medical colleagues, Drs. Olga Hansen and James B. Carey, who made the general physical examinations and supervised the medication in all of our cases.

## THE INCIDENCE OF DENTAL CARIES IN PREGNANT WOMEN\*

BY DANIEL E. ZISKIN, D.D.S., MINNEAPOLIS, MINN.

(Chief of Dental Staff, Minneapolis General Hospital, Assistant Professor, Department of Oral Surgery, University of Minnesota)

MANY theories have been advanced as to the possible causes of dental caries in adult women. Among them, the belief that pregnancy plays an important rôle as a causative factor has become so widely accepted that it is almost universally regarded as a fact, both by the laity and by the professions.

It occurred to me, during my observation of the mouth conditions of hundreds of pregnant women coming to the prenatal clinic at the Minneapolis General Hospital, that it would be of interest to study the relation between pregnancy and caries. With this purpose in view, the present investigation was undertaken.

*In this study, only pregnancy was considered as a causative factor, while any other theory which may have a bearing on the cause of caries in pregnant women was excluded.*

It would seem logical to believe that if we examined routinely the mouths of pregnant women and noted the frequency of the occurrence of decayed teeth, and later compared this group with a control group of women in whom pregnancy never existed, the conclusions derived from this comparison would clearly indicate whether or not pregnancy, per se, is an etiologic factor in caries of the teeth. Particularly would this be true if we could find two groups of women in whom, all other factors being equal, pregnancy was the only difference.

The cases which we have statistically compiled were taken from the records of pregnant women attending the Minneapolis General Hospital Dental Clinic from 1922 to 1925. These cases number about 25 per cent of all cases attending the prenatal clinic. The mouth examinations were made, for the most part, during the latter months of the period of gestation. Some of the cases in the control group were obtained from the women attending the dental clinic at the Minneapolis General Hospital, and the others from the women applying for dental examinations at the College of Dentistry, University of Minnesota. Of the latter, forty-nine were married women and seventy-two unmarried. None of the control group were ever pregnant.

The only apparent difference in the two groups is pregnancy. The patients came to these two clinics for mouth examinations in search of dental caries, for mouth hygiene, and for x-rays. They were referred

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\*From the Department of Dentistry, Minneapolis General Hospital and the University of Minnesota College of Dentistry.

Read before the Twin Academy of Stomatology, March 9, 1925, and the Minneapolis District Dental Society, March 11, 1926.

TABLE I  
CASE DISTRIBUTION FOR EACH AGE

AGE	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Pregnant Group	1	7	8	25	36	47	51	50	38	40	44	36	22	22	15	20
Control Group	6	9	5	7	12	20	13	17	9	12	11	12	15	5	2	7

CASE DISTRIBUTION FOR EACH AGE—CONT'D

AGE	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	TOTAL
Pregnant Group	17	21	17	15	13	10	15	7	6	5	1	3	3	1	3	599
Control Group	5	1	3	3	4	3	2	1	3	3	1	3	0	1	10	205

TABLE V

COMPARATIVE TABLE SHOWING AVERAGE FREQUENCY OF CARIOUS AND MISSING TEETH IN PREGNANT AND NEVER PREGNANT WOMEN

AGE GROUPS	NUMBER OF CASES			AVERAGE												PER CENT CARIOUS		
				AGE			CARIOUS			MISSING			CARIOUS AND MISSING					
				P*	II	C	P	H	C	P	H	C	P	H	C			
15-19	77	16	39	18.14	17.55	17.25	6.70	11.1	12.30	4.04	4.7	4.51	10.74	15.9	16.81	24	40	45
20-24	226	34	71	21.89	21.59	21.72	9.27	9.3	11.38	4.16	6.0	4.75	13.13	15.3	16.13	33	35	42
25-29	139	16	45	26.48	26.25	26.45	10.17	10.5	12.13	6.01	6.8	6.33	16.18	17.3	18.46	39	41	47
30-34	90	6	19	31.89	31.66	31.48	10.45	11.5	13.00	9.78	8.1	7.21	20.23	19.6	20.21	47	48	52
35-39	51	2	13	36.67	35.50	36.69	8.88	18.0	14.92	8.55	3.0	8.39	17.43	21.0	23.31	38	62	62
40-45	16	—	18	41.82	—	44.37	6.43	—	11.55	12.32	—	11.55	18.75	—	23.10	33	—	56
Group	599	74	205	25.95	23.00	27.05	9.22	10.4	11.67	6.01	6.0	5.94	15.23	16.4	17.61	35	40	43

\*P=pregnant, H=hospital, C=control.



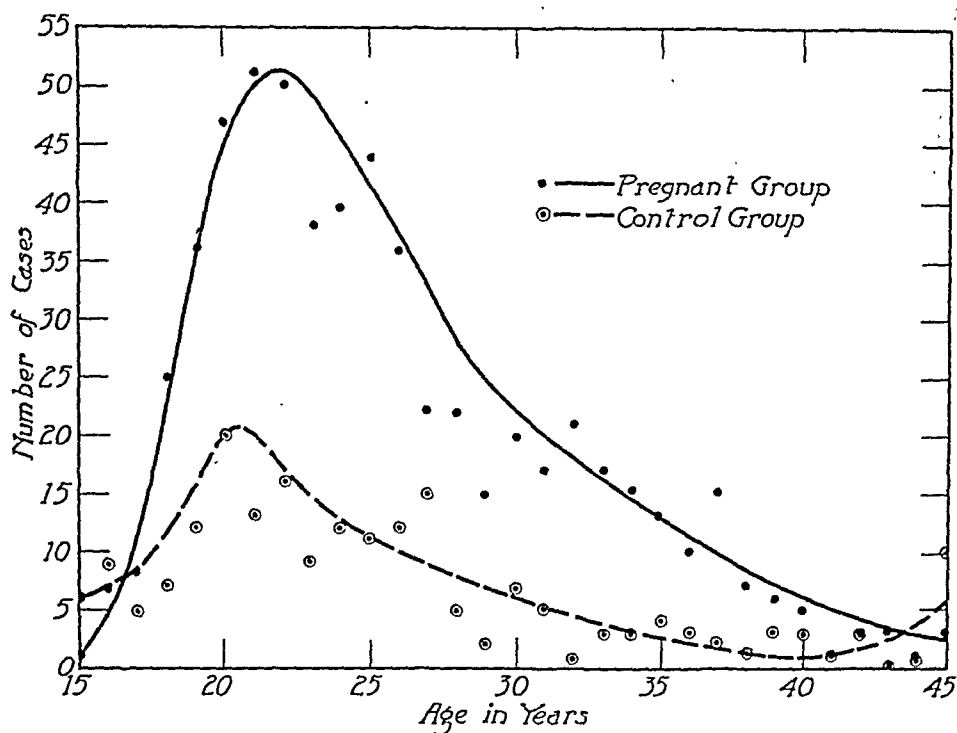


Fig. 1.

COMPARISON OF AVERAGES OF CARIOUS AND MISSING TEETH IN  
PREGNANT AND NEVER PREGNANT WOMEN

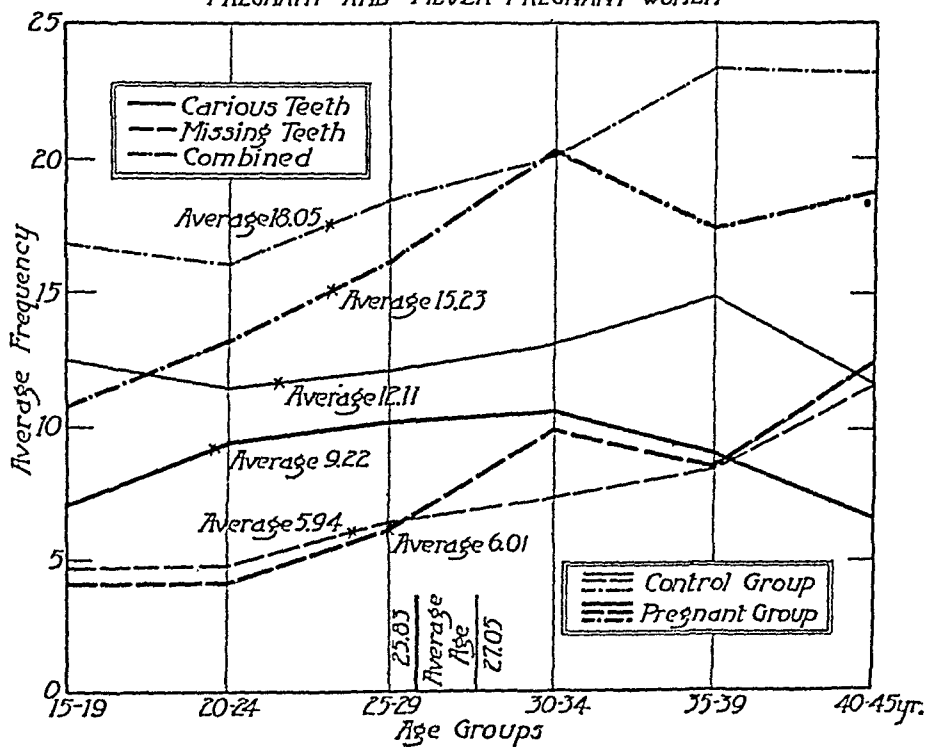


Fig. 2.

either by physicians or by medical dispensaries for relief from some definite dental ailment.

*Thus, in this comparison, we have two groups of women, both attending dental clinics, both from the same social strata of life, both of comparable financial means, and both falling within the same age limitations.*

In considering the frequency of caries, every tooth filled, crowned, or decayed was counted. If a tooth had both a filling and a cavity, it was counted only as one occurrence and not as two. The tables, therefore, represent the number of carious teeth and not the number of cavities. I also counted missing teeth as an evidence of caries. Teeth may be missing from causes other than caries, yet, for the purpose of this classification, they were given similar consideration in both the pregnant and control groups, as it is reasonable to suppose that in both groups there would be a like number of teeth extracted for causes other than caries, and this study tends to show a comparison between the two groups rather than a record of tooth destruction.

The ages of the women in both groups range between fifteen and forty-five years, with the exception of six cases in the control group and two cases in the pregnant group which are beyond the age of forty-five. For convenience, the cases were separated into six age divisions as follows: fifteen to nineteen years; twenty to twenty-four years; twenty-five to twenty-nine years; thirty to thirty-four years; thirty-five to thirty-nine years; and forty to forty-five years. All cases beyond the age of forty-five were included in the last division.

Table I shows the distribution of cases according to the various ages in both groups. Here we find that over half the cases in both groups fall within a ten-year period between the ages of eighteen and twenty-eight. Fig. 1 is a smoothed curve, showing the data contained in Table I. The peak of this curve for the pregnant group is at age twenty-one, with 51 cases. For the control group, the peak is at age twenty, with 20 cases. There are, in all, 599 cases in the pregnant group and 205 cases in the control group. The cases compiled here are intended for a preliminary study. A subsequent report with a larger group of cases will be given later.

TABLE II  
FREQUENCY OF CARIOUS AND MISSING TEETH IN PREGNANT WOMEN

Table II shows the cases in the pregnant group first separated into the six age divisions with the number of cases and average age for each. Next is shown the average incidence of carious and missing teeth for each division, first separately and then combined. The averages for the entire group are given below. The figures indicate teeth, carious and missing, in the average mouth for each age division and for the entire group, with the exception of the last column. Here is shown the per cent of caries only in teeth present at the time the examination was

TABLE III

FREQUENCY OF CARIOUS AND MISSING TEETH IN NEVER PREGNANT WOMEN

AGE GROUP	NUMBER OF CASES	AVERAGE				PER CENT CARIOUS
		AGE	CARIOUS	MISSING	CARIOUS AND MISSING	
15-19	39	17.25	12.30	4.51	16.81	45
20-24	71	21.72	11.38	4.75	16.13	42
25-29	45	26.45	12.13	6.33	18.46	47
30-34	19	31.48	13.00	7.21	20.21	52
35-39	13	36.69	14.92	8.39	23.31	62
40-45	18	44.37	11.55	11.55	23.10	56
Total	205	27.05	11.67	5.94	17.61	43
Group Averages						

TABLE IV

COMPARISON OF CASES IN HOSPITAL AND DENTAL COLLEGE GROUPS

AGE GROUP	NUMBER OF CASES	CARIOUS		MISSING		CARIOUS AND MISSING		PER CENT CARIOUS
		NUMBER	AVERAGE	NUMBER	AVERAGE	NUMBER	AVERAGE	
15-19	Dental 23	301	13.0	102	4.4	403	17.5	47
	Hospital 16	179	11.1	76	4.7	255	15.9	40
20-24	Dental 37	490	13.2	133	3.5	623	16.8	46
	Hospital 34	318	9.3	205	6.0	523	15.3	35
25-29	Dental 29	377	13.0	176	6.0	553	19.0	50
	Hospital 16	169	10.5	109	6.8	278	17.3	41
30-34	Dental 13	178	13.6	88	6.7	266	20.4	53
	Hospital 6	69	11.5	49	8.1	118	19.6	48
35-39	Dental 11	158	14.3	103	9.3	261	23.7	62
	Hospital 2	36	18.0	6	3.0	42	21.0	62
Total Number of Cases	Dental 113	1504	13.6	602	5.4	2106	19.1	51
	Hospital 74	771	10.4	445	6.0	1216	16.4	40

made. In the column headed, "Carious and Missing Teeth" it will be noted that there is a general tendency for a rise in the frequency of the occurrence of caries with an increase in age.

Table III shows a similar treatment of the control group. It will be seen that in the column headed "Carious and Missing Teeth" there is also a general tendency for an increase in the frequency of the occurrence of caries with an increase in age.

Since the cases in the control group were collected from two different sources, Table IV shows them separated according to each source and

COMPARISON OF AVERAGES OF CARIOUS AND MISSING TEETH IN  
PREGNANT AND HOSPITAL CONTROL GROUPS

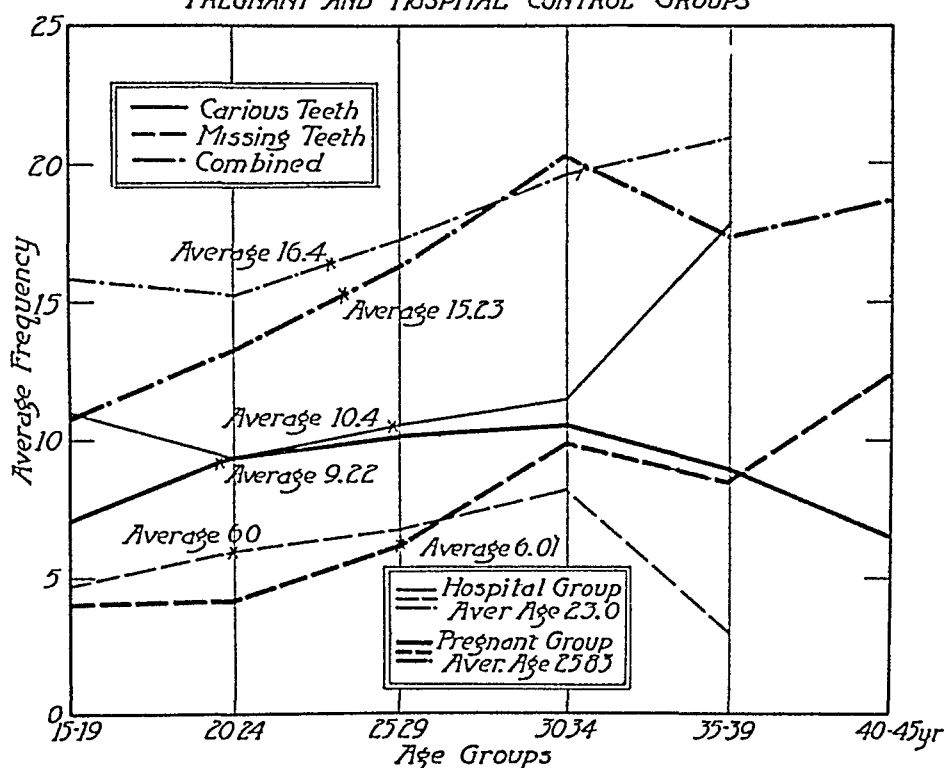


Fig. 3.

PERCENTAGE OF CARIES IN REMAINING TEETH  
PREGNANT AND CONTROL GROUPS

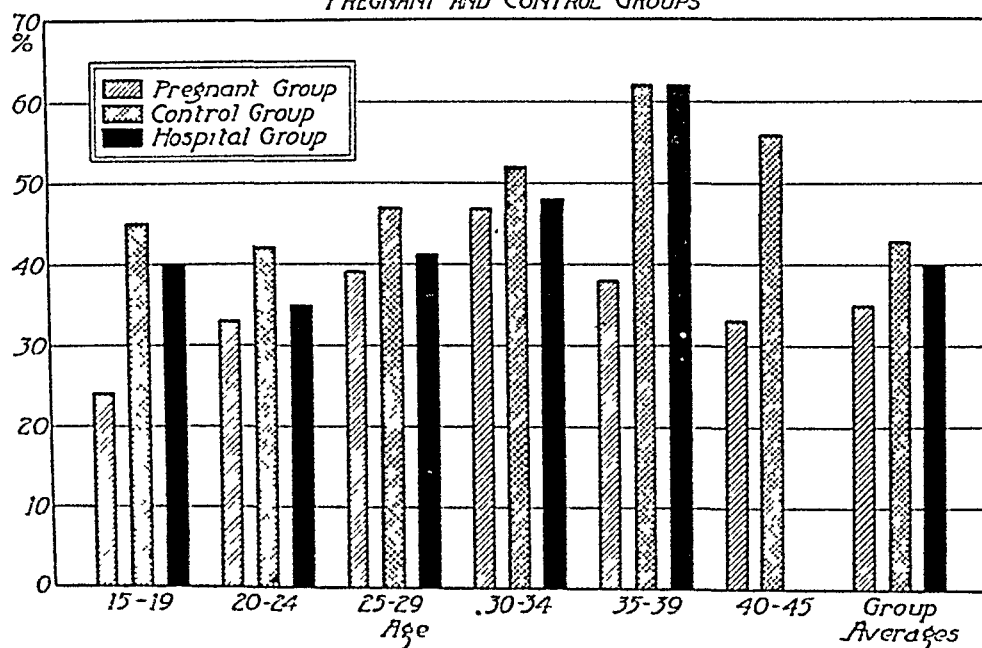


Fig. 4.

a comparison made between them. They are classified as "dental," for the Dental College group, and "hospital," for the Hospital Dental Clinic group. The comparison was made to determine the difference in the incidence of caries in the two groups. Here, as before, we find a general rise in the frequency of the occurrence of caries as the age increases. The cases in the Dental College group show a greater incidence of caries than those in the Hospital group, but this can be explained by the difference in ages as is shown in Table V.

Table V is a combined table giving the comparison of the frequency of carious and missing teeth in the following groups: the pregnant group; the hospital control group; and the combined Hospital and Dental College control group. This table shows the incidence of carious and missing teeth in the control group as actually higher than those in the pregnant group. A comparison of the ages, however, reveals the fact that the average age in the control group is higher than in the pregnant group. This explains the higher incidence of caries in the control group as, from the accompanying tables, we concluded that there was a rise in the occurrence of caries with an increase in age.

TABLE VI  
DISTRIBUTION OF PREGNANCY

AGE GROUP	NUMBER OF CASES	PREGNANCY								AVERAGE PREGNANCY	AVERAGE AGE
		1st	2nd	3rd	4th	5th	6th	7th	8th		
15-19	43	38	4	1	—	—	—	—	—	1.13	18.16
20-24	130	69	39	18	4	—	—	—	—	1.66	21.86
25-29	74	21	27	10	10	4	—	2	—	2.41	26.45
30-34	52	8	11	7	10	4	5	5	2	3.69	31.83
35-39	31	1	3	6	8	2	2	4	5	4.74	36.78
40-45	12	—	—	2	2	—	2	4	2	5.83	41.17
Total	342	137	84	44	34	10	9	15	9		
Average Age		22.07	25.21	27.57	31.11	31.00	35.33	35.43	37.00		

Figs. 2 and 3 show, diagrammatically, the data contained in Tables III, IV, and V. Fig. 2 shows a comparison, graphically, between the entire pregnant group and the entire control group.

Fig. 3 shows the comparison between the entire pregnant and only the hospital control group.

Fig. 4 is a bar diagram showing a comparison between the pregnant group, the hospital control group, and the combined control group. This study was made for the purpose of obtaining a comparison of the incidence of caries in remaining teeth only. That is, missing teeth were not counted. Here, as in the other figures, there is the same tendency to a rise in the frequency of occurrence of caries with an increase in age except in the latter division (forty to forty-five years) where there were so few cases that the comparison might well have been omitted.

A further consideration of the probability of pregnancy as a cause of caries may be shown in a classification of the pregnant women ac-

TABLE VII  
COMPARISON OF THE AVERAGES OF CARIOUS AND MISSING TEETH FOR PREGNANCY ORDER AND AGE GROUPS (342 CASES)

AGE GROUP	NO. OF CASES	AVERAGE AGE	FIRST PREGNANCY			SECOND PREGNANCY			THIRD PREGNANCY			FOURTH PREGNANCY			FIFTH PREGNANCY		
			PREGNANCY			PREGNANCY			PREGNANCY			PREGNANCY			PREGNANCY		
			C*	M	CM	C	M	CM	C	M	CM	C	M	CM	C	M	CM
15-19	43	18.16	7.13	4.13	11.26	11.25	3.75	15.00	2.00	4.00	6.00	8.25	4.00	12.25			
20-24	130	21.86	9.54	4.68	14.22	9.46	4.54	14.00	9.39	2.56	11.95	9.50	9.50	19.00	16.75	2.25	19.00
25-29	74	26.45	9.33	9.05	18.38	10.52	5.41	15.93	12.80	3.40	16.20	11.70	10.50	22.20	11.50	12.00	23.50
30-34	52	31.83	9.75	8.37	18.12	10.27	8.09	18.36	13.71	8.00	21.71	9.13	9.39	18.51	8.00	10.50	18.50
35-39	31	36.78	12.00	6.00	18.00	12.33	12.66	25.00	15.00	8.00	23.00	8.00	14.00	22.00			
40-45	12	41.17															
Average		25.95	8.87	5.42	14.29	10.10	5.54	15.64	11.29	4.43	15.72	9.82	9.38	19.20	12.90	7.80	20.70
Per cent carious			33			38			41			43			53		

COMPARISON OF THE AVERAGES OF CARIOUS AND MISSING TEETH FOR PREGNANCY ORDER AND AGE GROUPS (342 CASES)—CONT'D

AGE GROUP	NO. OF CASES	AVERAGE AGE	SIXTH PREGNANCY			SEVENTH PREGNANCY			EIGHTH PREGNANCY			AGE GROUP AVERAGE			AVERAGE PREG-NANCY	PER CENT CARIOUS
			C	M	CM	C	M	CM	C	M	CM	C	M	CM		
15-19	43	18.16										7.39	4.09	11.48	1.13	26
20-24	130	21.86										9.45	4.32	13.77	1.66	34
25-29	74	26.45										10.61	6.48	17.09	2.41	42
30-34	52	31.83	12.60	6.60	19.20	7.50	3.00	10.50				11.50	9.05	20.55	3.69	50
35-39	31	36.78	15.00	8.00	23.00	12.40	9.00	21.40	9.00	14.00	23.00	13.80	9.20	23.00	4.74	36
40-45	12	41.17	2.00	19.50	21.50	9.25	7.25	16.50	6.00	8.00	14.00	6.00	11.50	17.50	5.83	35
Average		25.95	10.78	9.78	20.56	9.55	7.47	17.00	11.00	10.77	21.77				2.48	
Per cent carious			48			39			52							37

\*C=carious, M=missing, CM=carious and missing.

cording to the number of pregnancies. If pregnancy is a cause of caries then the woman having the largest number of pregnancies should also have the largest frequency of carious and missing teeth. If, however, pregnancy is not a cause of caries, then the number of pregnancies will not add materially to the frequency of caries, but the age will be the determining factor.

Table VI shows the distribution of the cases in the pregnant group according to the six age divisions and to the number of pregnancies. Owing to the incomplete data, only those cases in which the number of

COMPARISON OF AVERAGES OF CARIOUS AND MISSING TEETH  
FOR PREGNANCY ORDER AND AGE GROUPS

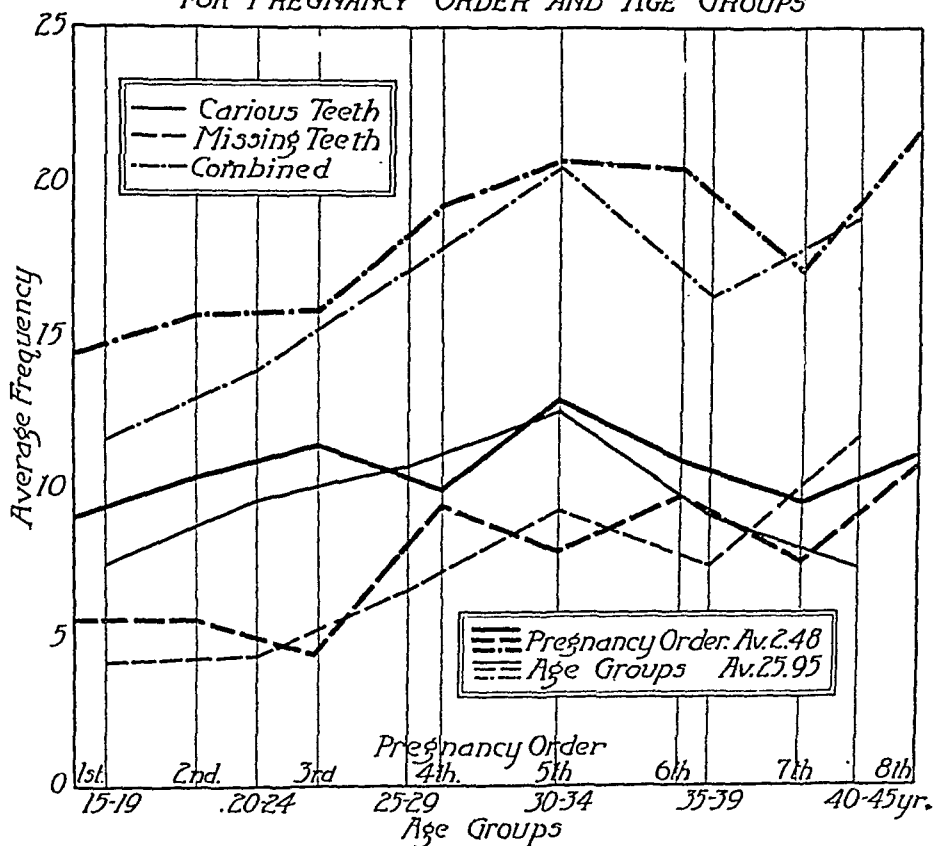


Fig. 5.

pregnancies were known were included in this table: 342 cases. Since there were so few cases of more than eight pregnancies, those exceeding this number were included in the eight-pregnancy group. This table also shows the average number of pregnancies for each age division as well as the average ages for both the six age divisions and the eight pregnancy groups.

Table VII shows the average frequency of carious and missing teeth in the known pregnancy group. The averages are calculated for each age division and for each pregnancy group. The per cent of carious teeth present at the time of examination is shown also.

Fig. 5 contains two sets of curves: one set showing average carious

and missing teeth according to pregnancy order, and the other showing average carious and missing teeth according to the age divisions; it also illustrates the data contained in Table VII. It will be noted here that the two curves rise in about the same degree. This tends to show that age is the determining factor in the increase in caries rather than pregnancy for if the pregnancy order influenced the frequency of caries, we would expect to find this curve much steeper.

#### CONCLUSIONS

1. Pregnancy, *per se*, cannot be given as a cause of caries of the teeth.

2. The foregoing data show that there is a rise in the frequency of caries with an increase in age.

3. The number of pregnancies does not influence the frequency of caries of the teeth.

Appreciation is expressed to Drs. R. E. Seammon and F. L. Adair of Minneapolis, for their valuable suggestions in the compilation of these data.

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### THE FREQUENCY AND MEANING OF BACKACHE IN GYNECOLOGY\*

BY FRANK W. LYNCH, M.D., SAN FRANCISCO, CALIFORNIA

(From the Department of Obstetrics and Gynecology, University of California Medical School)

THE study of backache forms a most interesting problem in medicine. It is now definitely known that backache may arise from any number of conditions which may be coexistent in the same individual, therefore, in an analysis from an etiologic standpoint, it is necessary to proceed with the utmost caution. It has taken a long time for medicine to arrive at this conclusion, and there have been many steps in the development of the opinion.

When gynecology first developed as a specialty, it was believed that pelvic conditions were the chief cause of backache. The view changed only when it became known that relief did not often follow the procedures directed toward the pathologic conditions, and that men also were liable to backache. At that time little was known as to the etiology of lumbago or sciatica, or of the rôle the prostate plays in causing backache. When the pendulum swung to the other side, the gynecologists became most conservative in their statements relative to backache. Indeed, H. A. Kelly in the nineties constantly cautioned his students not to definitely promise relief from backache in the presence of pelvic inflammatory conditions or in the marked retroversions.

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\*Read at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 1926.



The orthopedists made the next effort to establish the causes of backache. Meisenbach urged that since the sacroiliacs were true joints, they might slip when they became distended, and cause pain. In all, he reported 84 pathologic conditions of the joint. His work was followed by Lovett who, with Albee, also claimed that the sacroiliac articulations were true joints. They proved this by introducing colored fluids into them, thus giving outlines. However, the fact that the sacroiliac articulations were true joints had been known a long time. Albinus, in Leyden, nearly 300 years before, had proved it by convincing dissections. William Hunter had discovered the point anew and emphasized the importance of the joints in labor. A hundred years later, Senoir presented his specimens proving the point before the Paris Academy of Science. Luschka, in 1854, made similar observations regarding them and recorded them in the literature. The whole subject was most ably presented by Duncan's remarkable essays in 1867. Duncan emphasized the error of teaching that the pelvis is immobile since if it were true, men could walk in the most restricted manner and only after tremendous muscular exertion.

Lovett, however, is responsible for the first step in the modern conceptions of backache. He showed that it might be due to disease or displacements of the joint, to traumatism of the back, to arthritis of the spine as well as various pelvic conditions. However, he felt that the most common cause was static in origin and due to the overstrain of the muscles of the back, and that backache usually came from the irritation of these muscles, ligaments and fasciae. He also showed a large group of cases caused by strain or relaxation of the sacroiliac joint itself. Since the work of Lovett, the world has become well acquainted with the static factors. Nearly all believe that a forward displacement of the center of gravity is followed by undue strain on the back muscles. The pain results from fatigue and muscular irritation; although when the pain is in the neighborhood of the joint, it is difficult to say whether it comes from the muscles and fasciae about the sacroiliac joints or from the joints themselves. It is well known that in pregnancy the sacroiliacs as well as the symphysis are likely to have an exaggerated motility because of pelvic congestion. Because of the exaggerated stance in pregnancy, the sacrum may be readily pulled out of its place in articulation with the ilium and cause pain. Hence, any undue forward position of the body, if accompanied with a relaxed joint, would tend to displace the articulations and produce pain in that region. Thus, backache in fat men can be accounted for in many cases by muscular fatigue. The leg cramps in pregnancy doubtless follow muscular strain caused by Nature's effort to maintain a true footing in spite of the exaggerated abdominal position. With arthritis of the spine, there may be various nerve pressures; stiffness and lateral deviations of the spine may

also cause backache. There is x-ray evidence that osteophytes in the vertebrae and lipping in the vertebral edges may cause pain.

With the advent of focal infection, many other causes for backache were recognized. Billings stressed the importance of teeth, tonsils, sinuses of the head, the appendix, gall bladder, prostate, seminal vesicles and the female pelvic organs as chief sites of focal infection. The bacteriologic work of Rosenow and Dick has given this theory a reasonable amount of corroboration. It establishes the fact that backache may well represent some evidence of infection with or without disturbance of posture.

The influence of posture in gynecology was early urged by Dickinson. He called attention to the frequency of bad posture in women and proved his contention by a composite chart of the silhouettes of the back and abdomen of many cases. His work, however, has not aroused the interest that it merits. Since then, many men interested in gynecology have read papers on backache in women. Most of them discuss lightly the theory that gynecologic conditions may be an important factor in the complaint.

There are certain fundamental difficulties that attend any investigation of backache in gynecology. They attend the fact that bad posture is most common in women. Women do not stand as well ordinarily as men. They normally slouch and put overstrain on the posterior musculature. They have a high proportion of flat feet since they choose shoes that are governed by style and not by the needs of the wearer. Nearly all the complainants had borne children and had lax abdominal walls, and therefore tended to stand in an unusually ptotic position. The importance of fatigue is not sufficiently emphasized. Fatigue alone may be responsible for backache and because nearly all gynecologic cases complain of backache, it seems reasonable to assume that fatigue must be shared with static as well as with the pelvic conditions.

When reviewing this field, I found comparatively few articles that had been developed from a series of well controlled observations so that they could be regarded as definite conclusions. From the standpoint of pure theory, it seemed reasonable to believe that pelvic disorders might share with stance and fatigue the responsibility of causing backache, because women with comparatively slight pelvic pathology are likely to complain of backache when there is menstruation or premenstrual congestion. Women having backache usually say that it is more severe at the time of premenstrual congestion. There is also abundant proof that many women complain bitterly of backache until they are relieved by the cure of their dysmenorrhea, or of a marked uterine retroflexion, and that it ceases following the menopause. Backache in these cases is confined to the sacral or lower lumbar region and usually is referred to the upper sacrum. It is not

likely to be confused with the backache of fatigue which is usually referred to the dorsal region, although it is frequently confused with the orthopedic conditions.

Our interest in this subject was revived by reading the articles claiming that backache was rarely caused by gynecologic conditions. Up to that time, I had been impressed with the idea that many of my patients who complained bitterly of backache before operation were completely relieved after the correction of well-defined gynecologic conditions. I knew of no way to approach this subject but by a study of the pre- and postoperative symptoms.

Fortunately, we have a well ordered follow-up system in our Department in the University of California Hospital, in which we followed 90 per cent of cases with gynecologic conditions. Because we are conducting a study on the fate of the ovaries following hysterectomy, and of the meaning of retropositions, we had a large number of cases that had been followed carefully for several years, several hundred of them from four to nine years. We began our study with the review of 500 laparotomies which had been followed from one to eight years, many of which had vaginal work in addition. In calculating results, we thought that when the patient was permanently cured of backache by a gynecologic operation, we were justified in concluding that the backache was due to pelvic pathology, although there is always the chance that a good result might be due to an improved general condition. At the outset, we were fully aware of the many errors that might attend such an investigation, largely because the cases were not developed years ago primarily for such a study. Thus, to be of the greatest value, we should have a large series of cases which could be studied in similar groups of like postural defects of stance, etc., as long since advocated by Dickinson, or after they had been classified in various divisions, according to their individual reactions. Moreover, we should have as contrast a series of normal controls. While we could have arranged a series on this plan, it would have been too small to be of much value. For that reason, we confined our study of backache to groups of similar pelvic pathology.

As we proceeded with the work, we found that leads developed which required the addition of cases which only had cervical tears or vaginal relaxations. The results proved of such interest that we have now restudied the question from our histories of 1041 cases which have been followed accurately for a minimum of one and a maximum of eight years after operation.

Backache in the sacrum, or in the lower lumbar region, was a pre-operative symptom in 49 per cent of 1041 gynecologic cases and did not constitute a complaint in 51 per cent. Our follow-up suggests that it was due to a gynecologic condition in 76.5 per cent of all who

had backache, since the complaint disappeared following operation and did not return again to constitute any but an occasional and comparatively slight symptom during the one to eight years follow-up period after operation, except in the presence of new gynecologic conditions. There were 23 per cent of the backache cases who were not relieved by the operation, composed of 16.5 per cent whose backache was not cured and 7 per cent whose backache was only improved after operation. We believe that these figures indicate that orthopedic conditions may have been responsible for at least 16.5 per cent of all the sacrolumbar backaches in the series and possibly part of the 7 per cent of cases whose backache was only improved following operation. There is, of course, the possibility that many of these cases might have had other etiologic factors, such as extremely bad tonsils or teeth which were treated in the operative routine. At any rate, the backache was diagnosed as orthopedic prior to operation in a very considerable number of cases in the series. We have included all such cases in the review because it is a study of the frequency and meaning of backache in gynecology.

Our series of 1041 cases consisted of 28 ovarian tumors, each tumor more than 8 cm. in diameter, 101 fibroids composed of cases in which fibroids were the major condition, 434 pelvic inflammatory disease cases, 290 retrodisplacements, most of them combined with descent, cervical injuries, and vaginal relaxations, 125 generally relaxed vaginal outlets of marked size including cervical lacerations, and 63 cases of complete prolapse. The cases were first studied in the above divisions. We made little headway. We presently found that injury and defects of the floor were a tremendous factor in the symptoms. We then arranged each of the various groupings accordingly as the pathology was entirely intraabdominal, or presented cervical pathology in addition, or combined cervical pathology and vaginal relaxation in addition to the intraabdominal condition, or was limited entirely to the cervical lacerations and vaginal conditions.

The vaginal relaxations were limited to those of large size in women in the childbearing age. The pelvic inflammatory cases consisted entirely of chronic cases since we do not admit the acute conditions. As our study progressed, it seemed reasonable to study the pelvic inflammations in two general groups, accordingly as they were mild or more severe cases. The milder pelvic inflammations consisted of 210 cases, in which at operation it was necessary to remove only one tube and ovary, or rarely both tubes and one ovary, with or without vaginal work in addition. Nearly all of this group presented posterior displacements of the uterus which were Nature's reaction to limit the inflammation. Such cases must be carefully distinguished from the noninflammatory type of displacement to which they bear no resemblance. The more severe type of pelvic inflammatory conditions

consisted of 224 cases in which it was necessary to perform a hysterectomy. We studied these in two groups, accordingly as the hysterectomy was complete or limited to the amputation of the uterine body. There were 83 panhysterectomies and 141 supravaginals. These divisions were subdivided again according to the treatment of adnexal disease and the condition of the vaginal floor.

Low backache was present in 15.4 per cent of the ovarian tumors; in 34 per cent of the fibroids; in 49 per cent of the pelvic inflammatory conditions; in 61 per cent of the retroversions and flexions; in 71 per cent of marked vaginal relaxations in the women in the menstrual age, and in only 22 per cent of the complete prolapsus cases. Of the cases in which backache was a preoperative symptom, the complaint was cured by the gynecologic operation in 50 per cent of the ovarian tumors; in 72 per cent of the pelvic inflammatory processes; in 79 per cent of the relaxed vaginal outlets; in 80 per cent of the fibroids; in 81 per cent of the retroversions and flexions and in only 37 per cent of the complete procidentias.

Various interesting features presented as the study developed. For a long time, they merely added to the confusion. First of all, we were greatly impressed with the infrequency of backache in ovarian tumors. Nearly all the ovarian tumors were of a size in excess of a five months' pregnancy, the largest one weighing 60 pounds. Backache was present once in 16 simple tumors; it was absent in an adherent pseudomucinous tumor of considerable size that had recurred after a previous operation. It was present in only two of six ovarian cancers, none of which had broken through the capsule. One of these tumors was of a size which entirely filled the abdomen. Backache was absent in one large retroperitoneal parovarian tumor.

The 101 fibroids represented many types. Severe backache was a complaint of one woman of 50 who had a goose egg sized tumor adherent in the pelvis and with almost complete calcification. Yet there were several cases without backache with a growth firmly fixed in the pelvis by adhesions, or with deeply fixed broad ligament and cervical fibroids. We found that backache was often absent even when the circulation was developing rapidly in quickly growing but otherwise uncomplicated tumors because there is, we believe, no chronic passive congestion. Backache was a rare complaint when there was a single large tumor, or when the patient had increased bleeding. Severe backache accompanied several tumors that were growing rapidly in retroflexions and in those that were developing degenerations. Backache was frequent when there were many small tumors and the uterus was in retroflexion. It also seems that backache was more frequent when the ovaries were adherent to the posterior wall. The fact that backache was present in but 15 per cent of ovarian tumors and 34 per cent of the fibroids deserves considerable attention. The back-

ache often disappeared when a rapidly growing uncomplicated tumor arose from the pelvis into the abdomen, reminding us of similar findings in retrodisplacements of a pregnant uterus temporarily incarcerated in the third or fourth month of pregnancy.

The importance of chronic pelvic congestion began to be appreciated when we studied the retroversions and flexions. Nearly all of these cases presented also more or less descent and cervical injuries and vaginal relaxations. All were, however, simple cases not complicated by pelvic inflammation. Our first great lead came after we separated the simple retroversioflexions from those which presented cervical or vaginal conditions in addition. We thus were able to study cases in which the grossly apparent pathology seemed at first to be limited to the retroflexion but which in reality deals with disturbance of the pelvic circulation. We are perfectly aware that there is not complete agreement that the so-called simple retroflexions and retroversions may ever cause symptoms. We have, however, proved to our complete satisfaction by a prolonged follow-up study of approximately 500 cases that chronic passive congestion in retroflexed uteri of the third degree may occasion definite symptoms under certain conditions. We believe that symptoms invariably result, when the uterus is enlarged, if the displacement has followed parametrial injuries during parturition. The symptoms accompanying retroversion disappear after the menopause, although there is a persistence of the anatomic condition. We feel that the following factors favor the development of symptoms in the simple retroflexions: enlargement of the uterus because of chronic passive congestion; varicose veins of the broad ligament; prolapsed enlarged ovaries which hang low in the pelvis. We have found no cases of simple retroflexions which present symptoms in the absence of these conditions. In another study, we attempted to see if symptoms finally develop in women who have moderately displaced uteri, not enlarged, who come in without symptoms. We felt that a certain number must return ultimately with more marked displacements and evidences of a disturbed circulation if the condition was acquired because of deep fascial injuries during parturition. We were forced to abandon the study because of the difficulty of keeping the entire series under continuous observation for a term of years in the absence of definite symptoms: although now and then a case returned after having been lost sight of for some years, coming back with a greatly enlarged uterus and complaining of symptoms. In the present study, we divided the simple uncomplicated displacements into various subdivisions, grouping them first according to the length of the uterus as shown at time of operation. This gave us much help in arriving at conclusions. Many of these cases had come in because of pain, or backache, or difficulty in menstruation. We found that no single factor appeared to be responsible

for backache. Thus, there were many greatly enlarged acutely displaced uteri without backache; many cases of prolapsed ovary without backache; many cases of varicosities of the broad ligament without backache, but no case was seen presenting backache without several of these conditions. Many of our displacement cases had bad tonsils or bad teeth without backache. Gallstones and a chronic appendix or gall bladder did not seem to be a factor in producing the condition. Cystitis usually caused a definite backache. Backache followed in a number of cases where the tubes were cut and ligated; we wondered whether because of ovarian adhesions.

An entirely different type of retroversioflexion is found in the cases of pelvic inflammation. In this group, the retrodisplacement is secondary and represents Nature's effort to wall off a pelvic infection. The uterus is usually not enlarged since the chief lesion is in the tubes or ovaries. Backache is not a frequent complaint in the latest stages of these infections since the pelvic circulation has been cut down after the infection has been limited. We operate only for the residues of the pelvic infection. Our study shows that backache was very frequent in chronic pelvic inflammatory cases when the uterus was enlarged and congested and there was frequent or severe bleeding. The backache was often most marked in the period of premenstrual congestion and was relieved after the case began bleeding. It is worthy of emphasis that backache was present in 61 per cent of the 290 non-inflammatory retroversioflexions and in only 50 per cent of the retrodisplacements associated with tuboovarian inflammation. This we believe indicates the difference in frequency of chronic disturbances in the pelvic circulation. The backache was cured by gynecologic operation in 81 per cent of the noninflammatory retroversioflexions; in 87 per cent of the mild inflammatory conditions associated with enlarged adherent uteri in retroversioflexion, and in only 64 per cent of the later stages of the more extensive types of pelvic inflammation.

There seems to be a perfectly good reason for the long continuance of backache with the more severe pelvic conditions. The sacral plexus is separated from the pelvic viscera only by the pelvic fascia and readily receives its share of pelvic infection. It seems reasonable to believe that the nerve changes become chronic in the very bad cases with pelvic inflammation and require many months of rest before returning to the normal condition. We find that women are less disturbed with sacral pain after the menopause has developed, or operations or treatments have stopped or reduced the periodic pelvic congestion. We are strongly reminded of the backache that accompanies prostatic inflammation.

In the pelvic inflammatory group, we find points similar to those noted in the retroversions and flexions. The presence of a chronic gall bladder or gallstones or a chronic appendix did not seem to favor

backache. We are also greatly surprised to find a number of cases that came in for operation because of pain from former operative adhesions were free from backache. Cystitis again favored the production of backache. Two of the four cases of tuberculous peritonitis were free from backache; the backache was not cured in the other two cases. All of the group were treated by supravaginal hysterectomy with bilateral salpingo-oophorectomy.

We were greatly interested in the fact that none of six operable cases of cancer of the uterus had backache as a symptom. On the other hand, we rarely see cases with inoperable carcinoma in which backache is not an important symptom. Nor do we usually find backache in women whose complaint is idiopathic menorrhagia or the so-called fibroid uterus in which hemorrhage is a constant symptom.

A review of the relaxed vaginal outlets and endocervicitis cases gave interesting findings. There is no doubt but that backache follows congestion of an indurated parametrium caused by a lacerated cervix and some chronic infection. Backache was present in 71 per cent of women under forty years who presented very marked vaginal relaxations. It appeared as if it occurred more frequently when there were large high rectoceles or enteroceles than when there was large cystocele without cystitis. Traction on the broad ligaments may be responsible for the symptoms in which these cases resemble retroversionflexions with considerable descent and traction of the engorged parametrium. Backache was cured by gynecologic operation in 81 per cent of these cases of marked vaginal relaxation. Study of our tables shows that the percentage of backache is increased in any group of intraabdominal pelvic pathology if the cases have vaginal relaxations in addition.

In marked contrast to our findings in relaxed vaginal outlets are those in complete prolapse, a condition which, of course, is the last degree of vaginal relaxation. Backache in complete prolapse was present in only 22 per cent of cases and was cured by operation in but 37 per cent of them. This is opposed to the frequency of backache in 71 per cent of younger women with less marked relaxations of which 79 per cent were cured by operation.

The marked difference in the percentage of backache in relaxed vaginal outlet cases and in those of complete prolapse can be explained only on the basis of circulatory restrictions and loss of function in procidentia cases. Many of the prolapse cases stated that they had much backache when they were younger and before the uterus "came down." The large number of backaches in procidentia remaining uncured by operation calls attention to the fact that these women usually have markedly relaxed or pendulous fat abdominal walls, with bad posture, bad teeth, bad feet, and well-marked static conditions.



As the result of a preoperative and follow-up study of 1041 gynecologically operated cases that were carefully observed for periods varying between one and eight years, we believe we are justified in the following conclusions:

1. Sacral or sacrolumbar backache was a complaint in 49 per cent of 1041 women who came to gynecologic operation.

2. It constituted a complaint in 15 per cent of the 28 ovarian tumors; in 34 per cent of 101 fibroids; in 49 per cent of 434 pelvic inflammatory disease cases that came to abdominal operation; in 61 per cent of 290 retrodisplacements, most of which were combined with descent, cervical injuries and vaginal relaxations; in 71 per cent of the 125 marked vaginal relaxations in women under forty; and in only 22 per cent of the 63 complete prolapsus cases.

3. Backache may be ascribed to gynecologic pathology because it remained cured for periods ranging from one to eight years in 76.5 per cent of the 510 women of the series that had this as a preoperative symptom.

4. Backache was cured in the following percentages of the cases that had this preoperative symptom: 50 per cent of the ovarian tumors; 72 per cent of the pelvic chronic inflammations; 79 per cent of the relaxed vaginal outlets in women under forty; 80 per cent of the fibroids; 81 per cent of the retroversions and flexions; and 37 per cent of the complete procidentia.

5. Backache in gynecologic conditions is due chiefly to pelvic congestion. Comparatively slight defects in posture may favor the development of the condition.

6. Orthopedic conditions were responsible for between 16.5 per cent and 23.5 per cent of the total backaches of the series.

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(For discussion see page 759.)

# THE TECHNIC OF CESAREAN SECTION, WITH SPECIAL REFERENCE TO THE LOWER UTERINE SEGMENT INCISION\*

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## THE UNSATISFACTORY NATURE OF THE UTERINE SCAR AFTER THE ORDINARY LONGITUDINAL INCISION

PRACTICALLY all writers have been forced to the conclusion that in a fair percentage of cases the scar after the ordinary longitudinal incision is not satisfactory. Couvelaire<sup>1</sup> states that in 17 per cent of cases there is an unsatisfactory cicatrix, in 10 per cent extreme thinning of the cicatrix, and in 2 per cent rupture of the uterus. Losee,<sup>2</sup> McPherson,<sup>3</sup> and Findlay<sup>4</sup> give somewhat similar experiences.

Eardley Holland<sup>5</sup> organized, early in 1920, among a large number of obstetric surgeons in Great Britain and Ireland, a follow-up inquiry into the subsequent obstetric history of hospital patients who had had cesarean section performed between the years 1912 and 1918, inclusive. He summarizes his results in the following table:

Total number of cesarean section patients (excluding fatal and sterilized cases, and cases of repeated cesarean section where the first operation was performed prior to 1912) -----	1,605
Number followed up -----	1,103
Number in whom no subsequent pregnancy occurred -----	616
Number who subsequently became pregnant -----	487
Results of pregnancies:	
Delivery by natural passages -----	78
Repeated cesarean section -----	352
Abortion -----	47
Pregnant now -----	86
Rupture of scar -----	18

These figures show that the frequency of rupture of the scar in subsequent pregnancy or labor (cases of abortion and early pregnancy excluded) is 18 in 448, or 4 per cent; also, that the proportion of ruptured scars to cases of delivery by the natural passages is 18 to 74, or 1 to 4.3.

Two of the most important contributions to the macroscopic and microscopic appearances of the uterine scar of the ordinary longitudinal incision are by Gamble<sup>6</sup> and McIntyre.<sup>7</sup> The latter found in his investigations that the scars contained a relatively large quantity

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of fibrous tissue. He did not find, even where the healing process was most satisfactory, an absence of fibrous tissue and a muscle regeneration, as Gamble states occurs under ideal conditions.

We take it, therefore, that there is definite evidence that the uterine scar after the longitudinal incision is not as sound a scar as is generally supposed, and that it frequently gives way completely or partially.

#### THE REASONS WHY THE UTERINE SCAR WITH THE ORDINARY LONGITUDINAL INCISION IS SO FREQUENTLY DEFECTIVE

If a general surgeon were asked his opinion why the cesarean section wound is unsatisfactory in a number of cases, he would almost certainly give the answer that it is due to faulty technic. The explanation, however, is not so simple, for, as I shall try to indicate, the process of healing in the uterine wound is liable to certain disturbing factors which do not prevail in wounds elsewhere.

The first of these is the difficulty in securing complete asepsis. Now, this is specially difficult with the uterine wound, because of the danger of upward infection from the vagina. As cesarean section has often to be performed with the patient imperfectly prepared, and upon a structure so easily infected, it is not to be wondered at that even in the hands of the most careful and experienced operators infection of the uterus from below cannot always be prevented.

Another very important factor which militates against an absolutely normal healing in the uterine wound is the fact that the uterine muscle fibers during the puerperium are in a state of degeneration. An autolysis occurs in the muscle fibers. It is highly probable, therefore, that the healing process is interfered with in the early days of the puerperium as a result of this degeneration.

A third disturbing factor is the fact that the sheets of muscle which form the uterine wall are irregularly distributed, and this is seen very markedly in cesarean section whenever the uterus begins to retract. The surface of the wound, then, instead of being smooth, becomes irregular and puckered, and no matter how carefully the surgeon stitches the wound it is difficult to prevent the occurrence of small pockets of blood when he brings the surfaces of the wound together.

A fourth disturbing factor is the state of unrest of the uterus subsequent to operation. Not only does the uterus "retract," but from time to time it "contracts." If the uterus contracts before the sutures are inserted it will be observed that the edges and surfaces of the wound gape; while if the sutures are tied they appear strained when the uterus contracts. This alternate contraction and relaxation of the uterus, therefore, disturbs coaptation and lessens the hold the

stitches have on the tissues, and so favors the occurrence of small collections of blood between the coapted surfaces.

A fifth and very important factor is the necessity imposed upon the surgeon of using his ligatures not only as coaptors but as hemostatic agents. For the ideal healing of a wound, next to asepsis comes complete hemostasis. The general surgeon secures this by picking up bleeding vessels and if necessary applying ligatures to them. The obstetric surgeon cannot do this. He has to apply his sutures firmly if he wishes to stop bleeding and prevent the effusion of a certain amount of blood between the cut surfaces of the uterine wound.

There is yet another disturbing factor. If the placenta is situated on the anterior wall, and this occurs in about 40 per cent of cases, the operator will find that he has a layer of tissue peculiarly difficult to stitch and coapt exactly. It is very spongy, very friable, and contains large vessels; and, no matter how carefully he applies his sutures, blood collects between the edges and there is a tendency for a gutter to form along the internal line of the wound. Into this gutter at the subsequent pregnancy the membranes protrude and a hernia gradually develops: this is the ordinary method of rupture in a subsequent pregnancy or labor.

I maintain that these failures very decidedly militate against an absolutely sound uterine cicatrix.

#### ADVANTAGES OF THE LOWER UTERINE SEGMENT INCISION

Anyone who has employed this method and seriously studied the formation and anatomy of the lower segment must be impressed by the following advantages this area presents to the surgeon who is anxious to secure a sound uterine cicatrix. Both Eardley Holland and I have already referred to this matter in our writings on the subject.

1. The wall of the uterus in this area is thin, especially if labor has been in progress for some time; it is often not more than one-sixth of an inch in thickness.

2. The tissue consists of fibromuscular tissue as in the upper segment, but here the fibrous tissue is much more abundant. McIntyre has tried to estimate the relative proportion of muscular and fibrous tissue.

3. It is less vascular. It is surprising how slight is the bleeding when an incision is made in this area.

4. As a result the surfaces of the wound can be more accurately approximated, and the formation of these pockets of blood clot already referred to can be prevented.

5. This area of the uterus, although it does not remain absolutely

inactive after the uterus is emptied, is more passive; and the wound has a chance of healing better, for it is less disturbed than is a wound in the upper segment. One has only to look at the appearance of the lower segment, as shown by frozen sections, to appreciate this point and its importance.

6. The wound is completely covered with the bladder wall and peritoneum. This keeps the wound extraperitoneal, limits slight infection, and prevents any adhesions of the uterus to surrounding tissues and structures.

7. Should infection unfortunately occur, it is an area that can be reached from the vagina should that be thought necessary, for the cervix can be pulled down, the bladder reflected from the cervix, and the wound drained.

8. The wound in the lower segment is not put on the stretch during a subsequent pregnancy: it is only after prolonged labor that this occurs. Very different are the conditions in the upper segment when during the whole time of pregnancy one is in doubt as to how the scar will stand the strain of the ever-increasing distension of the uterus and the active contractions of labor.

9. As far as can be judged from the literature, the few examples of weakening or rupture of the scar with the lower segment incision have been cases in which a longitudinal incision was employed. The objections to this incision are detailed under "Technic."

#### TECHNIC OF OPERATION

The patient is placed in the Trendelenburg position. One-half c.c. of pituitrin is injected into the triceps muscle to secure prompt contraction when the uterus is emptied. A longitudinal incision, about six inches in length, is made through the abdominal wall in the middle line, the lower end just reaching the symphysis pubis. The lower end of the wound is then retracted over a protecting layer of gauze with a Doyen's retractor. The rest of the abdominal cavity is protected by packing off the upper portion of the operation area with gauze. A transverse incision is made through the loose peritoneal covering of the uterus, about halfway down the lower uterine segment. In recent cases my assistant, Dr. Hendry, and I have been employing a curved transverse incision with the convexity directed downwards. The object of this line of incision is to lessen the risk of injuring the vessels at the side. We are convinced that it is a much safer incision than the longitudinal one, for with the latter there is great risk of the wound extending into the upper contractile portion of the uterus. It is an interesting fact that in the few cases of rupture or weakening of the scar of the lower uterine segment incision, the line of incision in all the cases has been vertical. If the head is not

easily accessible, pressure on the fundus through the abdominal wall often brings the occiput into the wound. To avoid handling, especially in presumably infected cases, the head may then be picked up with a pair of short obstetric forceps, used as guides and not as tractors, and the delivery completed by pressure on the fundus. The umbilical cord is ligated and divided in the usual way. A self-retaining retractor is now inserted to keep the sides of the abdominal wall apart. If the cervix is not well dilated, the placenta is delivered by compression of the fundus through the abdominal wall, and traction on the cord. An intramuscular injection of a sterile preparation of ergot is given at this stage. If the cervix is known to be well dilated,—and this is a most important advantage in an infected case,—the placental end of the cord is dropped back into the uterus, the placenta and membranes being expressed *per vias naturales* when the abdomen has been closed. By this means intrauterine manipulations are reduced to a minimum. The edges of the uterine wound are now picked up with fine tissue forceps or temporary silk ligatures. The mucous membrane, with the innermost portion of the muscle coat, is now sutured with a continuous No. 1 chromic catgut suture, the edges of the mucous membrane being directed inwards towards the uterine cavity. The remainder of the muscular coat is then carefully approximated and sutured with a continuous No. 2 or No. 3 chromic catgut suture. Great care must be taken to secure completely the lateral extremities of the incision. The peritoneum over the uterus is then closed with a continuous No. 1 or No. 0 catgut suture, the operation area being thus completely shut off. The gauze packing is now removed, and the abdominal wall carefully closed in layers. The surface of the wound is secured with an anchored dressing.

#### RESULTS OF FIRST AND REPEATED OPERATIONS

The following is a brief summary of results in a series of 107 cases:

	TOTAL	MATERNAL MORTALITY	PERCENTAGE
Clean cases	82	0	0
Doubtful cases	25	4	16

In "clean" cases are included only those in which all preoperative vaginal examinations were carried out in hospital; "doubtful" include all the others. The interference in the latter series varied from the previous unsuccessful application of forceps under domestic conditions to unsupervised vaginal examinations by nurses or midwives: in twelve of the series, including two of the fatal cases, not less than five such examinations had been made in each case.

#### RECORD OF SUBSEQUENT LABORS IN 26 OF THE ABOVE CASES

Second cesarean section of the lower uterine segment type	17
Second cesarean section of the classical type	6
Spontaneous delivery of a smaller child	2
Low forceps	1

There were no maternal deaths in this series. In only one of the cases already referred to was any thinning of the scar found at the second operation, and that in a case where the patient had been several hours in labor.

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## THE OCCIPITOPOSTERIOR POSITION\*

BY CHARLES S. BARNES, M.D., PHILADELPHIA, PA.

NO APOLOGY is offered for presenting this much discussed perennial subject. The condition, the most common anomaly of pregnancy and labor, is of much importance and demands to be kept before the profession until we much better understand how to cope with it.

In regard to its frequency, as a primary condition, there is a wide variance of opinion. The percentages given for this position range from 11 per cent in a series in Sloane Hospital, 17 per cent in Johns Hopkins, 26 per cent in a series of Dubois, to an estimate of 30 per cent right occipitoposterior by Shears. Potter states that he finds it in 60 to 70 per cent of his cases, because he examines them early, before rotation has occurred. His protagonists and disciples will perhaps credit him with correct observation, while his antagonists will charitably say that he is deceived. Quibbling over its exact frequency is not profitable, but it is an important fact that this is by far the most common anomaly in obstetrics. Breech presentation, the next most common one, is only 3 or 4 per cent. It seems a fair average estimate that 20 to 25 per cent of all cases of labor begin primarily as occipitoposterior.

The condition is vexing, perplexing, often most troublesome and difficult, and not infrequently results seriously—even disastrously. It is responsible for a high fetal mortality and for frequent maternal morbidity. Cragin reports a series of 20,000 cases of labor, with 13 per cent persistent occipitoposterior positions, showing the high fetal mortality of 7.66 per cent. Hirst places it at more than 9 per cent. DeLee says of it, "The condition itself and the operations performed by reason of it, cause untold and untellable suffering; the chil-

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\*Read at a meeting of the Philadelphia Obstetrical Society, January 7, 1926.

dren's brains are damaged, the mothers' soft parts lacerated and destroyed. I am convinced that, in the United States, ten times as many babies are lost from this complication as from contracted pelvis." It is worthy of note, however, that contracted pelvis of minor or moderate degree is not infrequently a coincident condition or a causative factor in the anomaly.

The condition is often carelessly or ignorantly overlooked, not diagnosed, and labor blindly allowed to drag on, with little progress, until, in desperation, the attendant is obliged to do something. Early positive diagnosis is not generally easy; the multiplicity of methods of management suggested are confusing. I hope to emphasize some important points of diagnosis (diagnosis being so essential to proper treatment), to emphasize some generally approved principles of management, and also possibly to present a little which is more or less new, or not generally comprehended or accepted.

Doubtless a very large proportion of these cases have never been positively diagnosed as to whether primarily anterior or posterior, and clinically, by good fortune, it made little difference. Therefore, commonly, alert, intelligent, watchful, active expectancy is the treatment, provided the obstetrician has eliminated in his study of the case, certain causes of the anomaly; e.g., an undue disproportion (a markedly contracted pelvis, or an oversized child), or a tumor or other condition obstructing the birth canal. In such case, elective cesarean section should have anticipated labor. Or if placenta previa be present, perhaps an etiologic factor, the treatment of the latter encompasses the former.

Few occipitoposterior relations occur on the left, but many on the right. If the fetal back is found on the mother's right, it is generally reasonable to assume a probable diagnosis of "right occipitoposterior" rather than "anterior" until proved otherwise. On the right side, the posterior relation is perhaps twice as common as the anterior. A slightly contracted pelvis, especially in a primipara, is another factor adding weight to the probable diagnosis; or some other departure from the normal, sometimes slight, such as relaxed maternal tissues. The signs of this condition determined by external examination include asymmetry of the abdominal ovoid, sometimes a depression above the pelvic brim anteriorly, opposite to the fetal back, the latter toward the maternal dorsum; fetal small parts in relation to the mother's anterior abdominal wall; fetal heart sounds in the mother's flank. Beware, however, of the latter, because, as a result of the frequently accompanying deflexion of the head of the fetus, cardiac sounds may be best transmitted through its anterior chest wall, which is pushed out against the ventral maternal tissues, thus leading to the false belief of an anterior position. The plain fact is that positive diagnosis of the condition must often be held in abeyance until dilatation of the cervix is sufficient



to admit several fingers for palpation of the vertex. The common dictum that the small fontanel (the meeting point of three sutures) is in the posterior part of the pelvis and the anterior fontanel (the meeting place of four sutures) in the anterior part of the pelvis is correct; but practically, it is not always easy to determine which is which. Palpating an ear, especially the meatus and noting the direction of the larger, freer portion of the auricle, there need be no question about the latter being directed, in these cases, posteriorly. A positive diagnosis can thus be made.

Because of lack of nice adjustment between the fetal head and the lower uterine segment, the patients in all cases of occipitoposterior position are prone to have insufficient and irregular labor pains; dilatation of the cervix is apt to be slow, and early rupture of the membranes is frequent,—true in all anomalous relations of fetus to mother.

If dilatation is finally completed, the mechanism of the second stage, though frequently, as stated, accomplished spontaneously, is usually also prolonged. The wider part of the fetal cranium, the occiput, is seeking to engage in the narrower part of the available space of the pelvis; that is, the biparietal diameter in relation to the narrower posterior portion of the pelvis, in contrast to the bitemporal in relation to the roomy anterior portion. This relation causes increased resistance, impedes progress and tends to extend the fetal head, bringing larger circumferences of the fetal head in relation to the birth canal. Therefore engagement and descent are usually slow. Rotation, if it occurs, must be accomplished through an arc of 135 degrees, instead of the usual 45 degrees—three times the distance required in anterior positions. These cases, therefore, at best, are usually much prolonged and demand alertness, good judgment, and skill in their management.

A patient in late pregnancy with a probable diagnosis of occipitoposterior, should be instructed that, when reclining, she should lie on that side related to the fetal back; so during labor. Authorities claim that the change from a posterior to an anterior position has resulted from such attitude of the mother. The knee-chest position is also advised, or the less uncomfortable lateral prone with the hips elevated. Purely external manipulation is usually futile.

The obstetrician in attendance upon the case with a probable diagnosis of occipitoposterior seeks to lessen as far as possible, the suffering and the exhaustion frequently incident to the first stage, by approved general and often by special measures, such as the Gwathmey method. If labor seems to be progressing favorably, he may avoid vaginal examination, until such time as he believes the cervix to be completely or nearly dilated. A rectal examination may meanwhile be helpful.

If progress seems to be unsatisfactory, early vaginal examination is indicated, the attendant being prepared at this time, especially where

premature rupture of the membranes has occurred, to introduce, if need be, a hydrostatic bag, as an aid to complete dilatation.

Happy is the attendant who finds the cervix completely dilated or favorable for manual completion. This examination, sometimes the first internal one, should be thorough (the patient anesthetized), the examining hand in the birth canal palpating the head, noting its relation, whether above the inlet, engaged, or well in the pelvic cavity; whether fixed or freely movable, and judgment formed as to the relative size of the head and the pelvis. Even at this stage of labor, the examiner may find (it should be seldom so late) that he has been deceived as to the degree of pelvic contraction or size of the fetus and that cesarean section is indicated.

Usually, in the second stage of labor, one of a few safe practical courses is available. If the mother and child are in good condition, if the head is descending, and especially if anterior rotation of the occiput has already begun, this step in mechanism may be aided, at the height of a pain, by increasing flexion of the head (pushing up the forehead, Hodge's maneuver, or drawing down the occiput). Also by pushing back the sinciput or drawing the occiput forward, rotation thus encouraged, may be spontaneously completed. This accomplished, delivery by the natural powers may ensue, or if not, when the occiput has advanced to the anterior quadrant of the pelvis, the forceps may complete delivery just as in a primary anterior position.

While, to repeat, a large proportion of such cases either end spontaneously or may readily be terminated by the aid of forceps, as just indicated, yet perhaps one or more out of five such cases persistently and obstinately remain with the occiput directed toward the sacroiliac joint or rotate toward the sacral cavity.

Probably at least 5 per cent of all labors (the estimate is as high as 13 per cent) are *persistent* occipitoposterior. J. Whitridge Williams reports 5488 cases of labor with a proportion of 11 per cent. Shears estimates 10 per cent or more. So few of these terminate spontaneously, face to pubes (I have never observed more than two or three), that some artificial aid must be employed. A very large proportion of these cases demand artificial aid in the *upper part* of the pelvis, or, not infrequently, before there is engagement or even fixation of the head in the pelvis. This is especially true of primiparas. Uterine contractions, perhaps at no time good, and voluntary efforts, both become weaker, the patient is irritable and has signs of approaching exhaustion, often before or by the time the cervix is dilated.

The latter completed, a confidence may be felt that, very generally, delivery can promptly and safely be accomplished in one of two ways; either by version and extraction, or by manual rotation of the fetus followed with forceps. I approach these cases with an open mind, prepared to do whichever in my judgment is safest and best. As a preliminary, the lower birth canal is freely stretched from the vaginal

vault downward, the outlet receiving special attention. Usually there is no necessity for undue haste in the process of delivery. If not previously done, the relation of the child to the maternal structures is studied, as outlined above. If the head is freely movable above the inlet or, though apparently fixed, can, under anesthesia, be readily pushed up, podalic version and breech extraction is elected. Williams says: "When the head is arrested at the superior strait, version is resorted to as soon as one is convinced that spontaneous advance will not occur." If the head is engaged or low in the pelvis, manual rotation followed by forceps extraction is the choice. It is exceedingly rare that one of these procedures cannot be carried out. Failing in these, forceps delivery with the occiput posterior is usually quite possible. Whatever the method of delivery, especially if the latter, a mediolateral perineotomy is often clearly advisable. Delivery is thus facilitated and a deep perineal laceration avoided.

Emphasis of some points in the manual rotation of the fetus seems important. For example right occipitoposterior is the common condition. The patient in the lithotomy position, the maneuver will be facilitated if the operator takes a relatively low position in relation to the birth canal. Introducing his left hand and everting it so as to grasp the occiput of the child, the fingers at least as far forward as the right fetal ear, he gradually begins rotation of the occiput forward around the right arc of the pelvis. Coincidentally, the mother being well relaxed by anesthesia, the external hand manipulates the chest of the child, stroking the anterior shoulder towards the left of the mother. An assistant may help in the latter procedure. Gradually, cautiously, the occiput is brought into the right anterior pelvic quadrant, may be near to the symphysis. This rotation is very generally readily accomplished. Formerly I (sometimes to my great disappointment) failed at this crucial point, namely, holding the head in the corrected position while applying the forceps. The common teaching and practice has been to apply the left forceps blade first, for no sufficient reason except that the forceps is so made as to lock more readily when the blades are applied in this order. Recently this order of application in corrected right posterior position has been reversed. The left hand, having rotated the head, is kept in place to hold it and to guide the right blade to the right side of the fetal head. The latter applied, effectually holds the head in the corrected position. The left blade is then easily introduced, and while the process of locking is a little awkward, yet it is readily done by shifting the handles. This accomplished, the forceps delivery becomes one of right occipitoanterior. DeLee practices and advocates grasping the occiput with a vulsellum to fix it until the forceps is applied, but I think the method I employ is better and simpler. It was my purpose to have a forceps made for use in such cases, no different from the ordinary modified Simpson forceps, except designed to lock the reverse of the common one, the right blade to be introduced first. On inquiry, it

was learned that a member of our Society, Dr. Frederick E. Keller, had recently devised such an instrument.

The remaining method of delivery deserves, I believe, only brief discussion. This is commonly known as the Scanzoni method or maneuver. It consists, in principle, of application of forceps to the sides of the child's head (often most difficult), of rotation of the head so grasped, until the forceps is "upside down," then of removal of the forceps, and a reapplication, such an application as would be done after manual rotation. Special forceps have been advocated. Some authorities claim excellent success in the procedure, e.g., Williams, Shears, R. C. Norris, and Edgar. Many English authorities condemn the procedure; the German and French are said to take a more liberal view of it. It has warm advocates and violent opponents. However, all agree as to the danger involved to the child and to the mother; and, almost universally, advocates of the method, as well as opponents, emphasize the belief that the procedure is unsafe except in the hands of an expert. Why then practice or attempt a plan generally recognized as one beset with grave risk, when the simple safe procedure of manual rotation is readily available and may be made almost universally successful? DeLee and others have discarded the Scanzoni maneuver, and the former has not found it necessary to deliver with the occiput posterior, other simpler means proving more successful.

#### CONCLUSIONS

Many physicians fail either to comprehend the frequency of this anomaly or to appreciate that such labors are always more or less complicated, often most seriously so.

Diagnosis is too seldom made, and when made, so often too late for an intelligent and successful conduct of the case. The case frequently drags on, the attendant in careless ignorance of the condition.

A tentative working diagnosis may generally be made late in pregnancy or early in labor. If not sooner, certainly by the end of the first stage, a positive diagnosis should be made by palpating the fontanelles and particularly an ear.

The first stage, often much prolonged, should be so managed as to minimize the suffering and the exhaustion menacing the mother.

The first stage completed, the second may often, with great advantage to both patients, be shortened. Unless there is good evidence of proper spontaneous progress, active intervention, either with podalic version and extraction, or with bimanual rotation and forceps extraction, should be practiced. If the latter procedure is elected, it is indicated to introduce that blade of the forceps first which corresponds to the side of the pelvis to which the occiput is related. Thorough manual dilatation of the lower birth canal should precede either of the above plans of procedure.

## FURTHER STUDIES IN SEDIMENTATION\*

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SINCE our first publication (Baer and Reis<sup>1</sup>) there has been no new theory advanced which satisfactorily explains the phenomena of the sedimentation of erythrocytes. In 1924-5, Mandelstamm<sup>2</sup> found that, although the sera of pregnant women and the sera of infectious cases show an increase in their ability to agglutinate many bacteria, that this agglutination could in no way be connected or identified with the sedimentation reaction. Sometime earlier this same investigator<sup>3</sup> definitely proved that the sedimentation rate is dependent upon some change in the properties of the erythrocytes themselves as well as changes in the plasma content.

Salomon, *et al.*,<sup>4</sup> attempted to show a relationship between the cholesterol content of the serum and the sedimentation rate but were unable to do so. Kaufman<sup>5</sup> finds a lowered concentration of the blood plasma in the sedimented blood as compared with the unsedimented, and Groedel and Hubert<sup>6</sup> find no parallelism between the speed of sedimentation and the viscosity of the serum. Opitz and Frei<sup>7</sup> find no connection between the specific gravity of the plasma or the erythrocytes and the sedimentation rate.

The most rational explanation and that which is most generally accepted is based upon the number of negative charges carried by the erythrocytes. As the negative charges are taken off, either by the positively charged agglutinins present in the blood (Clausser,<sup>8</sup> Fahracus,<sup>9</sup> Hueber,<sup>10</sup> Vorschuetz,<sup>11</sup> Nees,<sup>12</sup> Schurer and Einer<sup>13</sup>), or by the globulins (whose presence increases the viscosity and decreased the negative charges, Salomon,<sup>14</sup> Vorschuetz,<sup>11</sup> v. Oettingen,<sup>15</sup>) the erythrocytes no longer repel each other and tend toward an increased rouleau formation. The speed with which they sink is directly proportional to the massiveness of this rouleau formation.

In the technic, the Linzenmeier hard glass tubes, 6.5 centimeters long and 5 millimeters in diameter, have now been generally adopted. They are scaled at the 1 c.c. level and also at the 6, 12, 18 and 24 millimeter levels† (Baer and Reis<sup>1</sup>). In this report, readings were based solely upon the speed with which the sedimenting erythrocytes reached the 18 millimeter mark. It was found unnecessary to use the

\*Presented at the Fifty-first Annual Meeting of the American Gynecological Society, Stockbridge, Mass., May 20, 21, and 22, 1926.

†These tubes were obtained from G. A. Ingram Co., 202 Bagley St., Detroit, Mich.

reading of levels attained at arbitrary time intervals such as one hour, etc.

One time-saving improvement has been devised by Haenkel and proved reliable by Herold,<sup>16</sup> who examined 200 cases, using both the Linzenmeier and the Haenkel technics. The latter is a centrifuge method which has the advantage of requiring only five minutes of centrifuging before the readings may be made, but require standardizing.

The sedimentation test in gynecology has been on trial for some years in this country and abroad. Its value has been emphasized by the following investigators since the appearance of the last article by the authors<sup>17</sup>; Popper and Kreindler<sup>18</sup> find the test a valuable aid in diagnosis and prognosis and with the simplicity of the technic deserves daily use; Nitschman<sup>19</sup> uses the test in the differential diagnosis of uncertain cases, especially in conjunction with a complete blood count; Froesch<sup>20</sup> believes that the sedimentation test is more delicate than the blood count can be; Nees<sup>11</sup> recommends it in all infectious cases; Bochner and Wassing<sup>21</sup> believe that it is "not only an index of the degree of absorption of catabolic products but also an index of the degree of resistance of the host and the virulence of the invading organism." Herold<sup>16</sup> uses the test routinely. Three workers report unsatisfactory results, Cherry,<sup>22</sup> Neuman,<sup>23</sup> and Schmitz.<sup>24</sup> Neuman states that in "the gynecologic cases which offer difficulties in determining the presence of inflammation, the results of the sedimentation test will not definitely decide the question," yet gives figures which are roughly comparable to the results usually obtained. His difficulty would seem to be one of interpretation. The figures obtained by Cherry and by Schmitz and Schmitz, on which they base their condemnation of the sedimentation test, are so at variance with the rates obtained in the various gynecologic case types by practically all other workers in this field, as to warrant the impression that their cases were complicated by undetected remote foci of infection or were cases of mixed pelvic pathology. The one article lists carcinoma and uterine fibroids as having identical rates and the other article instances the use of the test seventy-two hours after laparotomy, although it is generally accepted that wound absorption after laparotomy so increases the rate that the test is valueless for one week postoperative. That article also gives comparable rates for fibroids, retroversions and incomplete absorptions.

In the series reported here, the cases were carefully selected, the intention being to prove or disprove the clinical value of the sedimentation test. All patients showing remote active foci of infection, such as tuberculosis, sinusitis, otitis, cholecystitis, cystitis, pyelitis, etc., were eliminated; likewise patients with positive Wassermann reaction or with known history of syphilis. Patients with mixed pelvic path-

ology diagnosed before or during operation, were not considered nor were any whose erythrocytes numbered less than 4,000,000 per cubic millimeter, excepting suspect ectopic pregnancies.

There remained 325 patients answering the above requirements. In each of these, the pathology was proved by subsequent operation, although occasionally the preoperative diagnosis was incorrect. The sedimentation test, however, was always absolutely in accord with the pathology later found on the operating table.

TABLE I  
SEDIMENTATION TESTS IN GYNECOLOGY

Cases Under 100 Minutes

TYPE OF CASE	NO. OF CASES	HIGHEST	LOWEST	AVERAGE
Puerperal sepsis	28	45	4	16
Acute salpingitis	17	42	10	22
Late carcinoma	7	33	9	22
Pyelitis	6	45	13	31
Subacute salpingitis	16	84	24	56
Early carcinoma	4	115	45	65
Threatened abortion	8	140	40	71
Incomplete abortion	28	175	40	88
Bartholinitis	4	140	25	82
Miscellaneous	32	95	8	44

TABLE II  
SEDIMENTATION TESTS IN GYNECOLOGY

Cases Over 100 Minutes

TYPE OF CASE	NO. OF CASES	HIGHEST	LOWEST	AVERAGE
Ovarian cysts	7	230	60	113
Chronic salpingitis	8	167	52	117
Polyps	5	142	110	123
Endocervicitis	8	255	50	126
Plastic operations	41	255	73	135
Fibroids of uterus	36	310	75	146
Fibrosis uteri	15	240	60	147
Retroversion	11	300	95	146
Ectopic pregnancies	6	212	45	144
Normal women	12	390	132	184
Miscellaneous	24	274	110	126

The types of cases shown in the tables strikingly demonstrate the value of the sedimentation test as an aid in determining the presence or absence of infection. One hundred and twenty minutes is the generally accepted lower level of normal readings. All the types included in Table I fall below the one hundred minute level, the most acute infections being found at the top of the table, whereas the groups in Table II approximate one hundred minutes or more. In none of these latter cases was an acute infectious process found.

The diagnosis of these group types of cases in Tables I and II must depend primarily on a careful history and physical examination. As a further aid in such a classification, the leucocyte count is of little value and the temperature curve equally valueless except in puerperal

sepsis, acute salpingitis, septic abortions and pyelitis, whereas the sedimentation rate is, by these figures, shown to be distinctly confirmatory of the clinical diagnosis.

Moreover, in each individual patient in whom a differential diagnosis requires considerable consideration, the sedimentation rate can, and frequently in our experience has, aided in establishing the correct preoperative diagnosis. This series includes many patients in whom the sedimentation rate was at distinct variance with the clinical preoperative diagnosis and who at operation were found to have been incorrectly diagnosed, the sedimentation time harmonizing with the actual pathology found. For example:

CASE 1.—Mrs. B., nineteen years of age, para ii. Preoperative diagnosis uncomplicated myoma with bleeding. Sedimentation time 45 minutes (normal average for myomata 146 minutes). The tumor on removal was found to be a chorion-epithelioma.

CASE 2.—Mrs. A., thirty-seven years of age, para iv, complained of irregular bleeding, a malodorous discharge and loss of weight. Preoperative diagnosis was malignancy. Leucocyte count 8900, temperature 98, and the sedimentation time 235 minutes. Hysterectomy showed a simple fibrosis uteri.

CASE 3.—Mrs. D., age twenty-six years, nullipara, complained of lower abdominal pain and loss of weight. A mass was palpable in the region of both adnexa. The preoperative diagnosis was probable tuberculous salpingitis. The temperature was 99.2°, the leucocyte count 10,200 and the sedimentation time 165 minutes. Laparotomy revealed normal pelvic organs.

CASE 4.—Mrs. R. N., age thirty-seven years, complained of pain in the left lower quadrant for one year, accompanied by burning and frequency of urination. There was a tender mass palpable in the left pelvis. The temperature was 99°, the leucocyte count was 9300 and the sedimentation time was 134 minutes. The preoperative diagnosis was left tuboovarian abscess. Laparotomy failed to disclose any pelvic pathology.

CASE 5.—Mrs. T., age thirty-one years, complained of abdominal pain, profuse vaginal discharge, with occasional vomiting. Leucocyte count was 13,300 and the temperature 99.8°. There was a tender mass palpable behind and to the left of the cervix. The sedimentation time was 112 minutes. The preoperative diagnosis was pyosalpinx. Operation revealed an adherent retroversion.

The test is of definite value in determining the operability of tubal infections. Every patient with an acute or subacute salpingitis was treated conservatively, with semiweekly sedimentation readings and operated only when the sedimentation time reached sixty minutes or more. With one exception, every one of these patients made an uneventful recovery, the exception running a stormy and febrile convalescence. On the other hand several patients who were operated while the sedimentation time ranged from thirty to forty minutes, had protracted and febrile recoveries, in one instance with a generalized peritonitis.

Too much emphasis cannot be laid on the importance of repeated readings. The clinical picture and the physical findings may seem to



remain unchanged, the temperature curve and leucocyte counts may show no significant variations, while the sedimentation time is changing in direct relation to the changing condition of the patient. This holds good not only in determining safe operability, but even more strikingly in making a prognosis.

At best it is difficult to gauge the outcome of a septic abortion, a puerperal septicemia, or a spreading pelvic peritonitis. We believe that it is safe to make a good prognosis on the strength of a rising sedimentation rate regardless of the severity of the clinical symptoms, hyperpyrexia, or persistent leucopenia and conversely that a falling sedimentation rate is ominous in the face of apparent clinical improvement. For example:

CASE 6.—Mrs. M., age twenty-one years, para i, on the fourth day postpartum developed a temperature of 102.2°, with pulse 136, leucocyte count 10,600 and a sedimentation time of 7 minutes. On the sixth day, the temperature was 102°, pulse 114, leucocyte count still 10,600 and the sedimentation time 12 minutes. On the fourteenth day, the temperature was still 101°, the pulse 100, the leucocyte count 10,000, while the sedimentation time had risen to 18 minutes. On the twentieth day with normal temperature 98.6°, a pulse of 90, the leucocyte count was still 10,200 and the sedimentation rate had risen to 25 minutes.

#### SUMMARY

In a series of 325 selected cases each of which showed only one type of gynecologic pathology and no remote foci, the conclusions arrived at in previous publications are confirmed.

1. The sedimentation test is more useful than the temperature curve or the leucocyte count in determining the presence or absence of infection.

2. A sedimentation time of more than two hours rules out infection in the existing pelvic pathology.

3. The test is a further aid in determining the safe time for operation, sixty minutes being the lower limit of safety.

4. The sedimentation test is a more delicate prognostic index, good or bad, than either the leucocyte count or the temperature curve.

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## CERTAIN OBSERVATIONS REGARDING PROLONGATION OF PREGNANCY\*

By WILLIAM R. NICHOLSON, M.D., PHILADELPHIA, PA.

ONE of the main reasons for presenting a paper upon this subject is that in my early days as an obstetrician I was constantly bothered by the fear of serious results which might follow a prolongation of pregnancy. I, of course, had the experience common to all, that 6-8 per cent of pregnancies went beyond the expected date, but later I realized that for the most part such a fear is without any foundation. For a long time this knowledge has been a comfort to me, knowing as I do, that in the light of our present-day experience it is no longer needful to be alarmed at the mere continuance of pregnancy beyond the calculated date. In making this statement I do not wish to be misunderstood. I do not deny that rarely pregnancy may be prolonged so far beyond the so-called normal limits that if the case be not properly handled there may be very serious results to the child and mother, but what I do affirm is that this true prolongation is really rare and that when it occurs it can be detected in ample time to permit the handling of the case in an intelligent manner and with no more hazard to either child or mother than is a necessary accompaniment to the conduct of labor in the presence of relative degrees of contracted pelvis.

My belief as to the infrequency of prolongation is substantiated by the fact that a careful study of cases reported in the literature as being of this nature, so frequently shows a lack of evidence to substantiate the diagnosis. For instance, in one of the best papers on this subject which can be found in the literature, that of Ballantyne, there is a long list of cases with a synopsis of the salient points in their histories and my first intention was to make a study of these cases for the purpose of this paper, but a very superficial investigation convinced me that it was a useless expenditure of time as most of them were either so imperfectly reported by the original writers that no one could rightly judge of their value, or the facts stated were unsupported by suitable evidence. In other words the acceptance of the unsupported testimony of a patient relative to the date of fruitful coitus, is hardly in accord with the rules of scientific testimony. However, there is no question that occasionally a pregnancy may continue for decidedly longer than the usual period, and it is theoretically interesting to consider the possible causes of such a prolongation. As is well known, not having any knowledge as to what causes labor to start, it is not to be supposed that we will be able to determine the reasons for a prolongation. Various theories, however,

\*Read at a meeting of the Philadelphia Obstetrical Society, January 7, 1926.

have been advanced. Most of them can only be considered as foolish; for instance von Winckel thought that the male sex was more likely to result in a prolongation of pregnancy than would be the case if the child were a female. Why any such opinion was ever advanced by such a man, it is hard to realize. Again, it has been thought that absence of the head from the lower uterine segment might be a cause of prolongation. In support of this the known frequency of anencephaly in cases of prolonged pregnancy has been cited. It has also been stated that a woman who has a thirty-day type of menstruation is more likely to have a prolongation than the woman with the usual menstrual interval. One of the later theories for prolongation is founded on the idea that the fetal pituitary gland may play a part in inciting uterine contractions. Those who advance this theory call attention to the above-mentioned relative frequency of anencephalic abnormality, in which case the pituitary gland is generally absent. This belief is of course more in accord with the present-day fashion but is nevertheless purely and simply theoretic.

The *difficulties in diagnosing postmaturity* is another reason for my disbelief in its frequency. From the clinical standpoint the only symptoms which may be considered of value are of course those demonstrable during life, and of primary importance are any which may be found before birth. Those usually given are the weight and size of the child, the condition of the skin and the nerves and the degree of ossification both of the skull and long bones, together with the condition of the placenta, cord membranes and liquor amnii. It is not necessary in this paper to consider the postmortem signs though it may be said that even the postmortem signs are not necessarily proof of postmaturity. In fact, there are only two points which may really be considered before birth; first the size of the child, and second, the degree of ossification in the long bones, as shown by the x-ray. If careful studies have been made throughout pregnancy, and if *pari-passu* with the prolongation beyond the expected date, there is a steady increase in bulk in the size of the baby beyond the usual development, there may be a certain amount of importance attributed to the apparent size of the child. Though it must be remembered that the nutritional process going on in intrauterine life may be markedly accelerated, so that a child at the eighth month is often as large as another baby at full term, or later. With regard to ossification, it is unfortunate that the earlier ideas as to its value as a diagnostic sign of fetal development have been found to be fallacious, but we now know that the x-ray cannot be of as much value in this matter as might have been expected, since it has been determined that the period of appearance of the centers of ossification varies so much that none of them can be depended upon to establish fetal age within the limits of a month.

One of the main questions to be considered is how frequently pro-

longation of pregnancy is met with. The laity in general would, I am sure, affirm that it is a very common condition; one of the bothers of the obstetrician's life being the insistency of nearly all women that they must be going beyond term, when the earliest estimated date of their delivery has just been passed. Many of you have been frequently put to it to convince such patients that they have no cause to be alarmed and, if you believe as I do, to convince them that there is no need of induction of labor, in the great majority of instances. This opinion, namely, that prolongation of pregnancy is an entity frequently met with, is also held by many physicians as an inheritance from remote antiquity and it has been, and in my opinion continues to be, much too prevalent a belief even among many specialists in this branch. I fancy that some of those present can remember many cases seen in consultation, because of the fear on the part of the physician in attendance that the pregnant patient had so far passed term that serious dangers were imminent. As an example of the attitude assumed by some teachers of obstetrics, I may refer to a recent article comprising a series of 150 induced labors in which a prolongation of pregnancy, as evidenced by slight disproportion, was the reason for interference in 65 instances. The writer of this paper remarks that very probably the commonest indication for the induction of labor in the future will be prolongation of pregnancy.

Before an intelligent opinion for or against the frequency of prolongation of pregnancy may be formed, it is necessary of course to determine the normal period of gestation, and secondly what constitutes a true prolongation. We will all agree that we are most densely ignorant as to the number of days which constitute the period of gestation, not only in the human female, but also in the higher mammalia, and I am of the opinion, sharing it with many others, that there is no definite and fixed number of days which can be predicated as the normal. In other words, as I do not believe that a real prolongation is a common happening, neither do I believe that there is, even scientifically considered, a fixed gestation period; certainly there is none for practical everyday use. The reasons for this belief will help in clarifying some of the obscure points of this subject, at least as far as they have a bearing upon practical everyday questions of prognosis and treatment. They may be briefly stated and are as follows:

1. *Inadequacy of reports.* This has been previously considered.

2. *Analogy.* It is found that the cow, whose gestation period is analogous to that of the human female, and in which the date of insemination is controllable, varies in the duration of different pregnancies very decidedly. Thus Spencer found in a series of cases that there was a variation in the period of gestation of 93 days, while Tessier in a series of 446 cows found 19 with pregnancy lasting over 300 days and one in which it lasted 321 days. Of course the date of insemination was

absolutely certain in both instances just cited. Again Krahmer found that the same cow in her successive pregnancies has a very various insemination birth period. Cow 1 varied from 277 days to 286 days in seven pregnancies. Cow 2 from 276 to 283 in seven pregnancies. Cow 3 from 250 to 283 in eight pregnancies. Cow 4 from 280 to 292 in six pregnancies. Cow 5 from 299 to 304 in four pregnancies. Cow 6 from 276 to 295 in four pregnancies. Cow 7 from 275 to 303 in six pregnancies. Cow 8 from 275 to 321 in seven pregnancies.

Now when we consider the duration of pregnancy in the human female by analyzing a considerable series of cases we also find a decided variation. Thus, Reed in 500 cases (last day of flow positive) found that 112 women gave birth between the 281st and 287th day, 63 between the 288th and 294th day, 28 between the 295th and 301st day, 8 between the 302nd and 308th day, 6 between the 309th and 316th day, and 1 at the 301st, 311th, 314th, 315th and 316th day. Von Winckel in a series of 30,500 pregnancies in which the first day of the last period was known and from which the pregnancy was calculated, found 31 cases showing a duration of from 302 to 322 days. Merriman studied a series of 114 pregnancies (last day of last menstrual flow positive) and found 4 in whom pregnancy lasted from 302 to 306 days. Further, if one considers the variable factors with which one has to deal in attempting to determine the gestation period in the human female, one will certainly be convinced that the question of prolongation of pregnancy in any given case is a matter of great uncertainty. We generally can get definite knowledge of the first day of the last period and occasionally the date of insemination (it is to be remembered that spermatozoa may live three weeks in the tubes) but we, of course, can never obtain the date of ovulation or conception. As to conception while it usually undoubtedly occurs within three to four days after insemination and rarely later than the tenth day, there is nevertheless a possible interval of delay which may amount to twenty-three days. All we know about ovulation is that while it usually occurs from the eighth to the fourteenth day of the cycle and is, therefore, most constant just after the flow, it may on the other hand occur at any time during the cycle. It is, therefore, in all probability not unusual for conception to take place just before the first missed period instead of just after the last normal one. In other words, it is to be remembered that when we estimate the probable date of confinement as we calculated from the last period we are not estimating the period of gestation but only the menstruation-birth period, which experience has shown to be the most valuable criterion of the duration of pregnancy available to us, but which actually is but a very uncertain approximation of the actual period of gestation, which, moreover, may itself vary in rather wide limits also. Thus, experience shows that 50 per cent of births occur from the 274th to the 280th day after cessation of the last period, and that most of the re-

maining 50 per cent go into labor between the 260th and 274th day or between the 280th and 294th day, but that in from 4 to 6 per cent of cases pregnancy continues beyond 300 days. If we can obtain the actual date of insemination we find that usually the insemination-birth period may be estimated at 275 days, but naturally such data is in the vast majority of instances unavailable, and even if positive there is still a rather remarkable fraction of error which suggests the question as to whether there can be a postmenstrual conception by a premenstrual spermatozoa. Duncan, in 46 cases with date of conception established, found the average date of labor to be 275 days later. Ahlfeld in 425 cases found it to be 271 days later, Hecker, 273 days later, and Veit in 43 cases found it 276 days later. Now while there is not a very great discrepancy shown in the just-mentioned figures there is certainly a possible suspicion as to the verity of the dates of coition, and this is made more suggestive by the statistics of Nürnberger who, in 206 cases of pregnancy occurring in the wives of soldiers in the late war in whom the date of a single coitus was established without the possibility of error, found that labor occurred from 253 to 297 days afterwards. Another interesting point which may be gleaned from statistics of the recent World War is the relation which a single coitus resulting in pregnancy bears to the period of the menstrual cycle. Thus, Siegel found in a series of 300 one-time cohabitations which resulted in pregnancy, that there were 159 (53 per cent) on the sixth day following the beginning of the last flow; and Nürnberger, in 215 cases, found that in 41.3 per cent cohabitation had occurred early in the postmenstrual period, in 9.3 per cent in premenstrual period and in the remaining 49.4 per cent at various times during the interval. In a word, when estimating the probable duration of any pregnancy which has apparently passed well beyond the so-called "term," it is a good practice, in the absence of certain knowledge of the date of insemination, to subtract 23 days from the elapsed time. If, for instance, a woman shows a duration of 300 days, counted from her last period, she may well be only 277 days actually pregnant and, therefore, not a case of prolongation at all.

In the previous résumé of facts enough has been said to emphasize the uncertainty of the calculations upon which in ordinary cases estimation of the age of any pregnancy depends, and as a consequence the foolishness of establishing treatment whether active or passive based upon such necessarily fallacious data must be admitted. A realization of this fact develops the real intent of this paper which resolves itself into a plea for the study of every pregnant woman not alone or chiefly from the standpoint of the subjective history but rather from the standpoint of the physical findings which the individual case may present. That pregnancy may continue until in itself further prolongation is fraught with danger, must be admitted, though, as has been said, such a continuance is in my opinion unusual. Therefore it is essential that one

should be in a position to determine from physical examination whether or not an individual case falls in this category, since the danger of an actual continuation of pregnancy beyond term often results in such an increased size of the child, with special reference to cranial and bisacromial diameters and advanced ossification of the skull, that serious results to child and mother are only avoided by skillful treatment. In other words, as was said in the early part of this paper the problem is identical with that presented by a case of relative pelvic contraction. Barbour has said that the head of the child is the best pelvimeter and that is true today and always will be true. In my opinion it is far from necessary that the recent graduate of medicine should be qualified to perform a cesarean section; the student should not even be taught the application of the forceps to the truly high head, but he should be trained, at least during his attendance at prenatal clinics in his internship, so that he may be able to form an intelligent opinion as to the degree of adaptation between the fetal head and the maternal pelvis. As a result of many years' experience with senior medical students and internes I am forced to the conclusion that those of us who are teaching are falling far short of our responsibility in this regard. While it is true that this estimation of relative size demands experience and practice to enable one to determine the possibilities in the more narrow relationships which may exist between head and pelvis, it nevertheless has been a pleasure to me to observe how rapidly an interne will come to a correct conclusion in the ordinary case after the technic, well-established for this examination, has been demonstrated to him. Nowadays it is a universal practice among experts in obstetrics and also among intelligent general practitioners to study the pregnant woman during the last two months from the standpoint of her pelvic capacity and the relationship existing between it and the fetal presenting part. If such an examination shows a true disproportion between the passenger and the passage the case should be appropriately handled no matter whether she be supposedly a month before term, a month after term, or just at term. The methods of treatment suitable to the varying conditions do not interest me at this time though it may be well to state that it is years since I have felt called upon to induce labor for prolongation of pregnancy either in my private work or in the hospital services under my care; moreover in over 70,000 midwife case reports which have routinely passed through my hands during the last ten years, we have had but six cesarean sections for all causes and no woman has died as a result of forceps or version. We have had one craniotomy and some 60 cases of fetal deaths from forceps trauma, or other injury at birth which could be attributed to oversize of the child. When it is remembered that these operative deliveries are performed in the homes of these patients with no skilled assistance and by doctors of very varying

degrees of experience in this department of surgery, it seems justifiable to me to believe that prolongation of pregnancy in the series just quoted played but a very small part in the dystocia met with. In conclusion I affirm it as my belief that all available evidence supports the hypothesis with which this paper began; namely, that a true prolongation of pregnancy is unusual. On the other hand there is no intention to deny its occasional occurrence. As the induction of labor is not as simple and harmless a procedure as some would have us believe, my plea is for the study of the conditions presented by the individual case taking the history into consideration but subordinating it to the physical findings. It is the ascertained relationship of the presenting part to the fetus which should decide for or against interference rather than any fixed number of days of elapsed time.

2023 SPRUCE STREET.

(For discussion see page 769.)

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## ABDOMINAL PREGNANCY DEVELOPING AS THE RESULT OF A UTEROPERITONEAL FISTULA FOLLOWING CESAREAN SECTION

By JOHN T. WILLIAMS, M.D., F.A.C.S., BOSTON, MASS.

A CAREFUL search of the literature of abdominal pregnancy and cesarean section has convinced me that the case which I am about to report is unique: namely, a case of abdominal pregnancy developing as the result of uteroperitoneal fistula following this operation.

Mrs. O. C., aged thirty, para iii, was seen November 26, 1922, with Dr. W. H. Nute at the Exeter (N.H.) Hospital. Her first labor four years previously, was operative and resulted in a stillbirth. Second pregnancy was terminated by cesarean section two and a half years previously. Convalescence was normal.

*Present pregnancy.*—Last menstruation occurred January 26, 1922. Confinement was expected November 3, 1922. The patient was seen early in pregnancy by Dr. Nute and advised to have another cesarean at term. She refused to accept this advice and returned to her home in a neighboring town.

Apparently the pregnancy proceeded normally up to October 19, 1922. Fetal movements appeared during the fifth month, and the abdominal development seemed perfectly normal. On October 19, being then within two weeks of the estimated date of confinement, there was a profuse but painless, bloody flow, after which the fetal movements ceased.

A diagnosis was made by the local physician of fetal death in utero. As it was thought that the patient would shortly start up in labor and throw off the dead fetus, a policy of expectancy was maintained. As nothing further happened, however, up to November 26, the patient was sent in to the Exeter Hospital, where she was again seen by Dr. Nute. Believing that the uterus contained a macerated fetus which nature was making no effort to expel, Dr. Nute inserted several bougies through the cervix, apparently into the uterine cavity. No pains whatever followed. The bougies were removed after twenty-four hours. On the fifth day following, the patient's temperature rose suddenly to 102°.

I saw the patient late in the afternoon of November 26. Examination showed



the abdomen distended by a pregnancy at or near full term. No fetal heart could be heard, nor could fetal movements be detected. Fetal parts could be indefinitely outlined, but the presentation and position were not ascertained. The abdominal scar resulting from the previous cesarean was visible just to the left of the median line with its center opposite the umbilicus.

On vaginal examination one finger could be passed through the cervix with difficulty. No presenting part could be reached by the examining finger. On

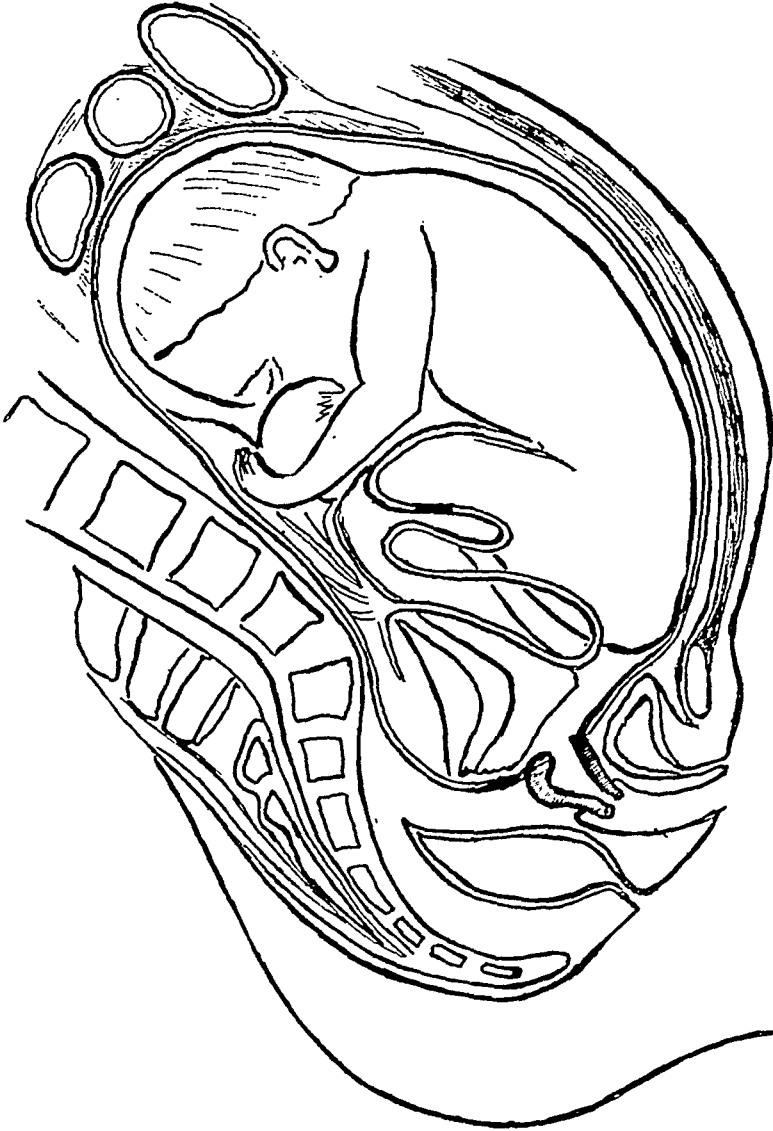


Fig. 1.—Diagram showing abdominal pregnancy. Note uterus (shaded) with fistulous opening on anterior wall near fundus through which the sound, introduced through the cervix, passed into the sac containing the fetus.

withdrawal of the finger there was a gush of dark, slightly foul, fluid blood. A sound was passed through the cervix for a distance of seven inches before meeting with resistance.

It was obvious that manual dilatation was impossible. The attempt to induce labor had already been made and had failed. The choice now lay between vaginal and abdominal cesarean section, and as the presenting part could not even be reached by finger from below, the abdominal route was chosen.

A midline incision below the umbilicus opened into a thin but tough-walled sac containing a macerated fetus of about full term development, presenting by

the breech, S.L.A. The fetus was extracted and the placenta was found densely adherent to the walls of the cavity. It was peeled off with some difficulty.

Exploration of the cavity now showed it to be enclosed by a rather thin but very tough membrane, covering, and adherent to the intestines behind and above, intimately adherent to the abdominal wall in front, and to the peritoneum of the pelvis and iliac fossae laterally. The general peritoneum was not opened. The uterus lay at the bottom of the pelvis, retroverted and imbedded in adhesions, and communicated with the sac by a fistulous opening in its anterior wall, evidently at the site of the former cesarean scar. The appendages were not seen. It was evident that the bougies and sounds, passed from below, had entered the cavity in which the fetus lay, through this opening.

Because of the patient's temperature and the foul condition of the contents of the sac it seemed inadvisable to attempt to dig the uterus out of the tough adhesions in which it was buried. The edges of the uterine fistula were denuded, therefore, and the opening closed with interrupted catgut sutures. The cavity from which the fetus and placenta had been removed was packed with gauze and the abdomen closed, except at the exit of the drain.

This drain was removed gradually, starting on the fourth day, and the patient made a protracted recovery. The temperature remained elevated for nearly two weeks. A profuse foul discharge from the sinus persisted for some weeks, but healing finally took place and the patient eventually returned home in good condition.

I report this case because of its unusual nature. Reports of defective and ruptured uterine scars following cesarean section are not uncommon. In this patient there was no sudden attack of pain and there was no intraperitoneal hemorrhage to suggest a rupture late in pregnancy. The density of the walls of the sac in which the fetus and placenta were enclosed made it obvious that the pregnancy had developed as an abdominal pregnancy at a very early period.

429 BEACON STREET.

# Department of Maternal Welfare

CONDUCTED BY FRED L. ADAIR, M.D.

## REPORT OF THE JOINT COMMITTEE ON MATERNAL WELFARE\*

DR. ADAIR reported that the representation on the Committee by the American Child Health Association, American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, and the American Gynecological Society, and the personnel, Dr. DeNormandie, Dr. Danforth, Dr. Kosmak, Dr. Lynch, Dr. Lobenstine, Dr. Mosher, Dr. Schwarz, and Dr. Adair, have remained the same as last year. The assignment of states and selection of men in the different states has progressed somewhat. The assignment of states and state leaders is as follows:

Dr. Robert L. DeNormandie: Maine—; Rhode Island—; Massachusetts—; New Hampshire—; and Vermont—.

Dr. W. C. Danforth: Illinois—Dr. Joseph L. Baer; Indiana—; Iowa—Dr. Floyd W. Rice; Ohio; Nebraska—Dr. Earl C. Sage; Wisconsin—Dr. Carl Henry Davis.

Dr. George W. Kosmak: Pennsylvania—; Virginia—; West Virginia—; South Carolina—; Mississippi—; and Connecticut—.

Dr. Frank W. Lynch: California—; Arizona—; Nevada—; Oregon—; Idaho—; and New Mexico—.

Dr. Ralph W. Lobenstine: Delaware—; North Carolina—; New Jersey—; Florida—; New York—; and Maryland—.

Dr. George Clark Mosher: Michigan—Dr. G. Van Amber Brown; Arkansas—Dr. Shelby Boone Hinkle; Missouri—Dr. Otto H. Schwarz; Kansas—Dr. John D. Clark; Oklahoma—Dr. William A. Fowler; and Texas—Dr. Calvin R. Hannah.

Dr. Henry Schwarz: Alabama—; Colorado—; Georgia—; Kentucky—; Louisiana—; and Tennessee—.

Dr. Fred L. Adair: Minnesota—; Montana—Dr. H. A. Tash; North Dakota—; South Dakota—Dr. S. A. Donahoe and Dr. N. T. Owen; Utah—; Washington—Dr. Richard O'Shea; Wyoming—; and the District of Columbia—.

The policy of the Committee has remained the same, namely, that of working with the physicians and surgeons of the country to interest them in raising the level of obstetric practice.

Recently there was published the "Standards of Prenatal Care,"† under the sponsorship of the Children's Bureau. This was worked out by a Medical Committee among the members of which Committee there were quite a number of those from the Committee on Maternal Welfare. The Joint Committee on Maternal Welfare accepts and approves the standards but it is not altogether in favor of the policy of Federal supervision. It is proposed to send out these prenatal standards, not necessarily in government form, but perhaps as a reprint, to all the secretaries of the County, District, and State Societies of the American Medical Association.

The Committee proposes, if it can be done, to proceed with the formulation and publication of some standards of natal and postnatal care and to have them

\*Made at the Fifty-first Annual Meeting of the American Gynecological Society. May 21, 1926.

†See Issue of June, 1926, page 854.

sponsored by the medical men and societies rather than by the Federal government. To that end Dr. Danforth will prepare the standards on natal care, Dr. Kosmak on postnatal care, and Dr. Lynch will elaborate the prenatal standards which have been published.

This Committee has been financially embarrassed from its inception, but five hundred dollars has been received from the American Child Health Association.

It might be stated that in the very beginning of the work an attempt was made to secure the cooperation of the American Medical Association through the Committee on Public Health and Legislation but no headway was made. However, in line with Dr. Carl Davis' suggestion of greater and better team work between special societies and A. M. A. sections, it is hoped some cooperation will be forthcoming through the Section of Obstetrics and Gynecology of the A. M. A. As to cooperative activities, it is desired to call attention to the work that is being done in New York State through the members of the profession cooperating with the State Board of Health. The Committee would like to suggest the plan which will be published in the American Journal of Obstetrics and Gynecology for your thoughtful consideration, and if similar plans can be worked out by men from the various states it might be of extreme value. It is felt that we as medical men cannot and should not take the position of hampering health activities on the part of the State and the Federal agencies unless we are prepared to substitute something for them which is equally good or better, and the only way we can accomplish anything constructive is by substitution of our own activities if we wish to curtail the activities of lay and governmental agencies.

For some time some of the nurses have been active in furthering a plan to increase the obstetric training and education of public health nurses, making it possible for them to handle obstetric cases. This is something to which we should give our attention as a Maternal Welfare Committee. Organizations of representative gynecologists and obstetricians should also give these proposals very careful consideration. This problem should be worked out, not alone by nurses and others who are interested, but in conjunction with physicians and not carried too far. These movements should not be national in scope because such activities on the part of nurses are not at all necessary in many communities. It may be the best temporary solution in some localities, but the best ultimate plan is the one for which all should strive. This nurses' and lay organization has asked the help and advice of our Committee and we are of the opinion that it is better to have an entente cordiale with them and try to solve these problems in cooperation with them.

The Rockefeller Foundation, which is interested in a study of maternal hygiene, has also asked our cooperation through one of its representatives, and she is going to make an extensive tour throughout the country looking up the activities of the welfare groups in different communities with particular reference to the effect of their work on maternal mortality and morbidity, and we have been asked by her to furnish the names of medical men in the different states. Your cooperation is solicited in case she calls upon any of you.

There is also the plan for better instruction of nurses in obstetrics which the Society endorsed last year. We propose to formulate an outline for the obstetric education of nurses.

A Committee of the American Pediatric Society, appointed to work out a better classification of the causes of deaths in the newly born, has asked that we cooperate with them in order that there may be a better understanding of these subjects.

A Department of Maternal Welfare is now established in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY and it is hoped to make it increasingly attractive and profitable in the future. We are anxious to have criticisms and suggestions as well as suitable contributions from any of you as well as from other interested parties.

## THE TOLEDO, OHIO, ACADEMY OF MEDICINE

### HEARTY HEALTH FOR WOMEN

A lecture course on the above topic has been made possible through the co-operative efforts of The Toledo Academy of Medicine, The Toledo Public Health Association, and The Ohio Department of Health. The program of a popular character consisted of five lectures given in the Academy of Medicine building, from November 8-12. The lectures under the Chairmanship of Dr. R. G. Leland, were as follows:—"Changing Modes and Manners" and "Preparing for Womanhood," R. S. Dixon, M.D., Specialist in Public Health. "Health of Our Mothers," Floyd S. Mowry, M.D., Obstetrician, Western Reserve University, Cleveland, Ohio. "Milestones on the Development and Care of the Child," Wm. M. Champion, M.D., Pediatrician, Western Reserve University, Cleveland, Ohio. "Examination of the School Child"—The Value of Such Health Work to the Child and to the Community, Don W. Gudakunst, M.D., Director, School Health Service, Detroit, Michigan. "More Abundant Health in Middle Life," J. H. J. Upham, M.D., Internist, Columbus, Ohio.

At the close of the lecture discussion by the audience was permitted.

# Society Transactions

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## THE AMERICAN GYNECOLOGICAL SOCIETY

### FIFTY-FIRST ANNUAL MEETING

STOCKBRIDGE, MASS., MAY 20, 21, AND 22, 1926.

*(Concluded from October)*

DR. JOSEPH L. BAER and DR. RALPH A. REIS, Chicago, Ill., read a paper entitled **Further Studies in Sedimentation**. (For original article see page 740.)

DR. JOHN OSBORN POLAK and DR. VINCENT MAZZOLA, Brooklyn, N. Y., read a paper on **The Clinical Significance of the Sedimentation Test as a Diagnostic and Prognostic Sign**. (For original article see page 700.)

### DISCUSSION

DR. WM. E. CALDWELL, New York City.—Our experience with the test in gynecologic cases has been limited and we have not as yet reached definite conclusions as to its value. In obstetric cases we always find an increased sedimentation, but believe that this fact is of little importance, either as a diagnostic or prognostic sign. Sedimentation is not greatly changed by the toxemias of pregnancy, although it seems to be decreased when there is serious vomiting. There are so many factors which influence the sedimentation time that the test by itself has not seemed to us of great diagnostic significance.

I was glad to hear Dr. Baer say that the test has been standardized. So many different techniques have been described in the literature, and are being used by different clinics, that comparison of the results is impossible.

DR. HARVEY B. MATTHEWS, Brooklyn, N. Y.—The gravity method in making the test seems to us to be the most accurate. We cannot see how readings can be very accurate when the centrifugal machine is employed. This test is of real value only if taken in connection with other clinical and laboratory diagnostic methods and only if repeated a number of times.

Dr. Polak spoke of the sensitiveness of this test. It is this sensitiveness that makes it of more importance than others we are in the habit of doing. It keeps us from operating on certain cases; it helps us in the differential diagnosis between chronic inflammatory disease and ectopic pregnancy. In the differential diagnosis of certain postoperative complications we have found that the test is of inestimable value. The test is a valuable addition to our modern laboratory methods.

DR. ROBERT T. FRANK, New York City.—No test is perfect and I am the last one to become overenthusiastic about any laboratory test, but I think I am about as nearly enthusiastic regarding this test as any that I have ever come across in medicine. I use the Lintzenmeier technique. Thirty minutes is our rule, and if the sedimentation is below that we do not operate, unless there is some vital indication. In about 150 cases it has proved of utmost value. The weakness of the test is, of course, as pointed out, that other foci, sometimes very difficult to diagnosticate, may interfere with the interpretation of the method.

I would like to call attention to the fact that we have noted in some cases that menstruation appears to favor a short sedimentation time and should be considered as a possible source of error. In one case I have in mind the test proved of utmost value to us. This was a case that had all the earmarks of a pelvic inflammation. The sedimentation time, however, was two hours or over, and I went ahead and found the pelvis filled with Sampson's chocolate cysts.

DR. I. H. NOYES, PROVIDENCE, R. I.—We have recently completed a series of 190 blood sedimentation tests made on 146 different women. In our normal controls the sedimentation time varied from two to four hours or more. In normal pregnancy it diminished as frequency advanced. In two cases of ectopic, one ruptured and the other a tubal abortion with free blood in the pelvis the sedimentation time was 64 minutes and 40 minutes respectively. There were six cases of pelvic abscess, the lowest sedimentation time being 10 minutes, and the highest 25 minutes. Here the inverse ratio between the sedimentation time and leucocyte count remained constant. Inasmuch as a sedimentation time of less than 30 minutes did not always signify a bad prognosis or a protracted recovery, it seemed to us that this test alone should not be relied upon in determining safe time for laparotomy in acute pelvic inflammation, but rather should be considered together with temperature, leucocyte count and clinical findings.

DR. ARTHUR H. CURTIS, CHICAGO, ILL.—Did Dr. Noyes say that he got a short sedimentation time in tubal abortion?

DR. NOYES.—There were two cases of ectopic. One was ruptured, the other, a tubal abortion, with the pelvis filled with blood, which showed a sedimentation time of 40 minutes. The ruptured ectopic with the pelvis also full of blood showed a sedimentation time of 64 minutes. That does not concur with the findings of some other observers.

DR. CURTIS.—That is in contrast with Dr. Baer's observations, is it not?

DR. NOYES.—Yes, it is.

DR. CURTIS.—I would like to ask Dr. Baer to discuss the problem of sedimentation time in tubal pregnancies. There seems to be some discrepancy.

DR. JOSEPH L. BAER, (closing).—I think it well to emphasize at the outset that we are clinicians and not laboratory technicians. We are treating patients and not simply making tests and, of course, the clinical course is the outstanding factor in handling our patients. We use the leucocyte count; we use the thermometer; and now we should use the sedimentation test as well but not place it above clinical observation.

I deliberately introduced into my paper two flat errors in diagnosis to illustrate merely that the sedimentation test in those two cases was a very slow reading, the reading of a normal woman. Nevertheless, the diagnosis had been made in both of these cases and the abdomen was opened and found negative. That was not meant to exalt the sedimentation test above clinical observation, however. In obstetrics we have found it of little value. Of course, the puerperal septicemias fall into the category of rapid readings, but aside from that I believe there is little to be gained from the use of the test routinely in obstetrics.

I must disagree with Dr. Matthews who says that one reading is of no value. One reading that is a fast reading definitely means that there is a focus, and to discard that signal I think is an error.

In tubal pregnancies our tests all show slow sedimentation. These were all ruptured cases, but early before there was a very acute anemia; and we had one reading of 144 minutes. The unruptured case, I think, would show a reading

comparable to that of normal women. There is no infection; there is apparently no agglutinin or globulin disturbance, and no absorption.

As to the value of the test in postoperative cases, in wound absorption there is a definite disturbance in the blood stream and the reading after operation until the acute wound condition has subsided is a rapid reading, quite regardless of what the pathology is or for what the patient was operated upon, and whether she shows a breakdown in the wound afterward. Even with a clean wound after a number of days there is a rapid reading, and I am not sure that that has prognostic and differential value in the early convalescence, so that we have taken the time limit that the European workers have set, which is eight days post-operative, before the test can again be relied upon. Dr. Polak's figures and mine were comparable almost throughout, except that he had for fibroids only 74 minutes, whereas for uncomplicated fibroids we have 36 cases with 116 minutes.

DR. JOHN O. POLAK, (closing).—In regard to that last point, our average normal was lower than Dr. Baer's. In our clinic all of these tests were made by one man. Maybe that explains the constancy of having a lower average for our uncomplicated fibroids than Dr. Baer has. I would say again that the method used in arriving at these conclusions was identical with Dr. Baer's, the modified Lintzenmeier method using the 18 millimeter mark.

Don't let us give you the impression—either Dr. Baer or myself—that we are overenthusiastic, but we do want to leave with you one point, and that is that in addition to our clinical data the proper interpretation of the sedimentation test may save a few women from needless operative procedures. I am convinced of one thing, that in cases of potential septic abortion which we are all treating daily we have in repeated sedimentation tests a positive index, and if it is credited there will be fewer of them interfered with because it warns us of the potential possibility of extending that infection by breaking down nature's barriers.

DR. FRANK W. LYNCH, San Francisco, Calif., read a paper entitled *The Frequency and Meaning of Backache in Gynecology*. (For original article see page 719.)

#### DISCUSSION

DR. EDWARD H. RICHARDSON, BALTIMORE, MD.—Some eight years ago I made an intensive study of this subject (*Southern Med. Jour.*, 1918, xl, 139) which was prompted by the failure of operative procedures to cure a definite percentage of cases. This study included not only the clinical side but also a review of both the gynecologic and orthopedic literature of the subject. I reached the conclusion that the actual cause of the backache, in so far as pelvic pathology is a factor, is chronic strain upon the lumbosacral and sacroiliac articulations brought about by faulty posture. Oftentimes this faulty posture results from protective attitudes. These patients naturally assume whatever posture affords the greatest measure of relief from the intrapelvic pain, but in so doing they bring about a defective balance from an orthopedic point of view and, hence, chronic strain upon the joints. I am grateful to Dr. Lynch for showing that congestion must be included as frequent cause of pelvic discomfort, but I believe the associated low back pains are more rationally interpreted as orthopedic in origin. Many of these patients will resume normal postures upon correction of the particular pelvic pathology and their back pains disappear, but there remains a very considerable percentage of cases in which this happy outcome is not achieved until surgical procedures are later supplemented by orthopedic measures to correct faulty posture.

DR. R. R. SMITH, GRAND RAPIDS, MICH.—I believe that most of our difficulty in agreeing on and understanding "backache" and its relations to gynecologic conditions arises from the fact that we have included under this term too great a



variety of disorders and symptoms. We should throw out all diseases of the spine, arthritis, localized or general; strains of the sacroiliac joints; injuries of the spine, sometimes associated with congenital defects of the lower lumbar vertebrae, and the occasional cases of tuberculosis.

The commonest form of backache we see in practice is a *lumbar* backache in the muscles or in muscles and fascia. This form of backache has very little to do with gynecologic conditions. Its most common cause is fatigue. A second cause is faulty posture, which is oftentimes associated with fatigue. Then there are cases of lumbar backache, I believe, due to focal infections. We all have seen some of these cases relieved by the removal of infected teeth or infected tonsils.

A *sacral* backache is a very different thing. It is a referred or reflected pain. A condition in the pelvis causes this pain in the sacrum and it has nothing to do with the muscles or joints. Dr. Lynch emphasizes that he is speaking only of sacral backache. Sacral backache may be caused by gynecologic lesions. I am not able to understand why an uncomplicated ovarian cyst or fibroid, unless they be of large size, should cause sacral backache. A certain proportion of women with normal pelvic organs have pain in the sacrum when they menstruate.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—Dr. Lynch's statement that the majority of sacral backaches were due to pelvic congestion, I believe is very well founded when one realizes the large number of women who have pelvic relaxation and consequently a stasis in the pelvic veins. Furthermore endocervicitis is always attended with some degree of posterior parametritis.

Endocervicitis of varying degree is constantly found postpartum and should be cured before the patient is discharged. When one realizes the immense enlargement of the pelvic vein in every pregnancy, one must appreciate that a routine dealing with this pelvic circulation is going to improve these backaches. We teach our patients from the sixth day to use the knee-chest position, and follow that up with the monkey trot for a number of weeks and it is amazing to see the difference in the pelvic congestion of patients so treated and those untreated. We have reduced our postpartal retroversions from 30 to 3 per cent. Lately we have developed the "mule kick," which is something more adaptable to our present housing conditions.

DR. GEORGE GRAY WARD, NEW YORK CITY.—Out of 560 of our cases in which there was backache associated with gynecologic anomalies as far as we could tell, about 80 per cent were relieved by an operative procedure.

The point brought out by Dr. Smith is very important. The interne takes the history and the patient says she has a backache, which may be not the type that Dr. Lynch has referred to at all, or the type that my own study referred to. I believe that there is a definite sacral backache due to pelvic congestion, the result of uterine displacement.

If you relieve in such cases the pelvic congestion by posture, replacement of the uterus, pessary or operation, you will cure the backache.

I found that about 15 per cent of our cases were not relieved by operative procedure, and this led me to establish an orthopedic clinic in the Woman's Hospital. The backache in these cases is found to be due to arthritis, sacroiliac diseases, flat foot, faulty posture or something of that kind. There is a definite need for an orthopedic study in all these cases.

DR. JAMES E. KING, BUFFALO, N. Y.—A short time ago I found that 75 per cent of all women who consulted me came either for relief of backache as their chief symptom or else gave backache as one of their concomitant symptoms. I classify backache in two forms principally. One is the orthopedic form which consists of sacroiliac conditions. The other is the pelvic type and is due to two

causes; one is pelvic congestion as is seen at the menstrual period, the other due to displacements that cause unusual drag on the ligaments. This classifies roughly the types of backache most commonly met. Clinically, women who suffer from any tugging or pulling on the uterine supports will always find relief by lying down. The sacroiliac backache is not relieved by lying down but is often made worse.

It has been rather a surprise in this discussion on backache to hear so little reference made to the Albert Smith pessary. The pessary is one of the most valuable single contributions ever made to gynecology. It not only will relieve the pelvic types of backache but will often aid in differentiation. A backache which is not relieved by a properly adjusted pessary will seldom be helped by surgery. It is very unfortunate that more stress is not laid on the pessary in teaching the medical student. Most students have but vague views and no practical knowledge concerning it.

DR. DOUGAL BISSELL, New York City.—It seemed remarkable that no reference has been made by the essayist to the use of the pessary as a means of relieving backache. I have no doubt that the Albert Smith pessary is of great value but it has always seemed to me that the Emmet pessary conforms to the natural curve of the vagina whereas the Albert Smith's posterior curve is too sharp and strikes the cervix, failing to force it back as far as it should go.

My experience has led me to the conclusion that the faulty position is the result of the physical effort on the part of the patient to relieve the backache and is not the cause of the backache for, when these conditions are found associated and the uterus is replaced and held in proper position with a well adjusted pessary, backache is at once relieved and a correct body position is assumed. There may be exceptional instances, of course, but this is the rule. Many symptoms may result from retroversion but I believe backache is the symptom most commonly met with.

DR. GEORGE W. KOSMAK, New York City.—Many of these women, particularly of the small, thin, asthenic type, who are operated upon for backache in which some gynecologic cause seems evident, have come back with the complaint that the backache is worse. A point not taken into consideration is that to the backache from the gynecologic cause we have added a backache due to a traumatic cause. The woman in a lithotomy position on the operating table will acquire a dislocation of the lower portion of the column, which results in backache often worse than the one due to the original cause, and we should take care to avoid this accident by appropriate cushioning of the table.

DR. FRANK W. LYNCH (closing).—This paper really started as an obstetric follow-up study. We discovered incidentally that we cured 75 per cent of the women who could wear a pessary. The second part of the material for this paper was prepared from a follow-up study of 500 cases, which Dr. Maxwell did, on the function of the ovaries after hysterectomy. As we proceeded with this work we tried to observe the posture of these women. We were familiar with Dr. Dickinson's work, and made silhouettes of these women to see the effect of posture, and we tried to obtain careful histories. We always studied their feet. There are two kinds of flat feet, the congenital type which does not bother them at all, and the acquired. We also take into consideration the flexibility of the spine, ascertained by bending the patient over. Most of these women were young because they came from our obstetric clinic and therefore they were not the type of people who would have ptosis from inflammatory conditions.

We do believe that the series is large enough to convince us, particularly if we take into consideration the experience of the urologists, that the pelvic congestion has a great deal to do with sacral backache.

DR. JOHN A. MCGLINN, Philadelphia, Pa., read a paper on **The Treatment of Granuloma Inguinale with Tartar Emetic.** (For original article see page 665.)

#### DISCUSSION

DR. EDWARD A. SCHUMANN, PHILADELPHIA, PA.—This matter of granuloma inguinale brings up so interesting a phase of American medical history that it is well worth a brief review. When I was an interne at the Philadelphia General Hospital, these cases were always to be found in various departments of the hospital and were diagnosed and treated according to the predilection of the particular specialists to whose wards they were assigned. In the department for tuberculosis this disease was termed lupus, in the gynecologic ward it was epithelioma of the vulva and in the venereal service it became syphilis. This went on until 1920, as Dr. McGlinn has stated, when there occurred a case in Bellevue Hospital in which Dr. Douglas Symmers became interested. While studying the case, Dr. Symmers was showing an Argentine medical visitor through the wards, who upon seeing the patient remarked that it was a well developed case of granuloma inguinale. The case was later reported by Symmers and Frost and if I am correct, was the first recorded American incidence of the condition.

The one note with regard to the treatment of granuloma inguinale which I would emphasize is that one should be exceedingly careful to exclude the disease before attempting any operative procedure.

DR. ROBERT T. FRANK, NEW YORK CITY.—The question of granuloma inguinale has interested me greatly since I encountered a case in Colorado. Two operations for carcinoma had been done on this patient in a neighboring state. The condition responded to treatment with antimony but afterward became resistant to it. Because of the severe joint pains resulting from the injections these patients can only stand a certain amount of treatment, and usually return only when they grow worse.

Recently in New York I saw a white patient with what appeared to be a granuloma inguinale. It is surprising that in an adjacent city like Philadelphia cases of granuloma should be so numerous, while in New York there should be so few seen although our attention has been called to it. Other localities have been referred to as endemic centers.

I see no reason to mistake tuberculosis for granuloma. It is not, in my opinion, identical or confusable with granuloma. In the first place, the exuberance of granulomatous tissue is not similar, and it has not the same tendency to spread. Unfortunately, the granuloma inguinale is an uncharacteristic lesion without specific histologic criteria. The Donovan organism has never been proved to be the actual causative factor, because Koch's postulates have never been fulfilled.

I would like to ask Dr. McGlinn in how many of these cases the Wassermann reaction was positive, because luetic infections of the vulva sometimes assume shapes which even practiced dermatologists cannot diagnose as characteristic.

DR. FRED L. ADAIR, MINNEAPOLIS, MINN.—I have seen only one case of this sort in all the years I have been on the service at the Minneapolis General Hospital.

The patient gave a history of menopause ten years previously. It was first diagnosed primary carcinoma of the vulva. The diagnosis on biopsy was somewhat obscured by the fact that flies had invaded this growth and there was a good deal of inflammatory reaction. However, an ultimate microscopic diagnosis of granuloma was made by the pathologist and this patient was treated with radium, in 1915. She had a considerable adenopathy in the right inguinal region. The large mass was incised and treated with a radium tube and radium needles were inserted in the groin. Subsequent biopsy showed the recurrent mass to be a squamous-celled carcinoma.

(The doctor showed a second slide with the striking improvement that has taken place. The next slide showed complete healing.) I saw the case just the day before I left Minneapolis, and she showed evidence of a slight recurrence.

DR. WILLIAM P. HEALY, New York City.—The question of the possible similarity between granuloma inguinale and esthiomene has been brought up. There is a very definite clinical distinction. Granuloma inguinale is a painless lesion; esthiomene is an intensely painful lesion. I reported a case of esthiomene, in discussing a paper of Dr. Taussig's two years ago, which was under my supervision for a period of some months. The woman was pregnant and we had to keep her constantly under the influence of morphine.

I have at present two cases of granuloma inguinale under my supervision at the Memorial Hospital.\* One is a colored and the other a white woman. Radium has helped the colored patient, but only temporarily. We resorted to tartar emetic also with benefit for a time, and then there was recurrence of the lesion. I feel that Dr. Adair has been very fortunate in his case in getting such a complete cure for even such a short period of time. I think that it was possibly largely the result of his surgical treatment of the case.

DR. JOHN A. MCGLINN (closing).—The first case I reported some years ago as tuberculosis of the vulva was shown before some of our postgraduate students. It showed a four-plus Wassermann and was promptly diagnosed by the students as a case of syphilis. Then I tried to impress upon them that because a patient had syphilis was no reason why she should not have another disease in addition to the syphilis. In our cases few have shown positive Wassermann reaction, but the lesion has been absolutely not influenced by antisyphilitic treatment. As Dr. Frank has said, the histologic study of granuloma is not typical because it shows syphilitic granular tissue with a number of leucocytes, the same condition which you find in other tissue.

Referring to Dr. Adair's very favorable result with the use of radium, while on the screen it looks like granuloma, I would almost doubt the correctness of the diagnosis, for in our cases radium has had no influence whatever. In some of our cases, however, x-ray did influence the lesion, but the amount of x-ray necessary to bring about a favorable result is so great that you have to discontinue the x-ray treatment because the skin will not stand a sufficient dosage to bring about any sort of a favorable result.

It has not been proved that the Donovan organism is the cause of granuloma. While you can grow it in broth culture, inoculation experiments have never produced granuloma. Furthermore, implantation of the growth by inoculation of the healthy part of the body has not produced granuloma. We feel, however, that the Donovan organism does possibly play a part because after a second dose of tartar emetic the organisms disappear entirely from the smears and cannot be obtained again.

I feel that so many mistakes in diagnosis have been made in this lesion, and so many operations done on patients condemned to a long period of suffering without something being done, that it is worth while to emphasize the entity of this lesion and its specific treatment.

DR. J. C. LITZENBERG, Minneapolis, Minn., read a paper on *The Relation of Basal Metabolism to Sterility*. (For original article see page 706.)

#### DISCUSSION

DR. WILLIAM P. HEALY, New York City.—The question of sterility, of course, is one constantly presented to the pelvic surgeon and to the obstetrician for solution, and frequently it is unsatisfactorily solved in the apparently healthy

woman. That is the group to which Dr. Litzenberg, as I take it, refers in his paper, not the definitely endocrine type that is identifiable by outstanding symptoms.

I feel that the ideas presented by Dr. Litzenberg are worthy of very earnest study and consideration. His statistics indicate that undoubtedly by a careful selection of cases some of these women will conceive if appropriate treatment overcomes their low basal metabolism.

DR. HENRY T. HUTCHINS, BOSTON, MASS.—We must remember that a lowered basal metabolism, of course, is not always of endocrine origin; that the metabolic rate may be lowered in a great many ways. It may be thyroid failure, pituitary failure, and also may be due to fatigue or general inanition. Therefore I think Dr. Litzenberg has stated facts correctly when he says that we must regard a low metabolic rate as an *indication of a cause* rather than the cause itself of sterility.

Dr. Lawrence, of Boston, found in his cases of thyroid failure 40 per cent of sterility. In going over his cases he had found two males who had thyroid failure and they both were impotent. But I think in general we must not place all the blame on the endocrines, although there must be something from the endocrine side.

DR. DONALD MACOMBER, BOSTON, MASS.—I have recently thought we are dealing here with a real clinical entity. I believe there are two periods during a woman's life when this entity is particularly called to our attention; one, during adolescence when there is a delay in the appearance of the menses; and secondly, after marriage when there is so apt to be sterility. I believe that this entity is characterized by more than just a low basal metabolism in many instances. In many of these cases we see an increase in the weight over the normal, an amenorrhea of varying length from one to many months, or a scanty menstruation which may be associated with irregular periods. These are not cases of myxedema. They are young women as a rule; they have no mental disturbance; and apart from a slight general inefficiency they have no other symptoms than those mentioned. After the administration of thyroid they almost invariably state that they are more energetic, and are more normal.

In the past year or more, since our attention has been called to this subject, we have had the basal metabolism done on 45 cases where an endocrine disorder was suspected. Of these 20 had a basal metabolism of minus 10. These patients were occasionally of normal weight but usually the weight ran from 20 to 25 pounds and occasionally 35 pounds over so-called normal weight for their age and height. There were no signs of myxedema. Occasionally one would encounter a palpable thyroid. One case was a woman of 18, unmarried, with an infantile uterus. She had a basal metabolism of minus 35. In the married women the uterus was sometimes bordering on the infantile, but usually well within normal limits.

DR. J. C. LITZENBERG (closing).—The "shotgun" glandular tablets of pharmaceutical houses all contain thyroid which is practically the only endocrine which gives any result by mouth, and whatever results there are usually come from the thyroid extract. The use of any of these tablets is inadvisable. The fact that low basal metabolism is not always of an endocrine origin is the reason for my statement that it may be a cause, or the index of a cause. We have plenty of cases of low basal metabolism that may be successfully treated by simple feeding.

This investigation has led us into many bypaths; for instance, we found menstrual disturbances in 40 per cent of these women, which compares well with the 39 per cent of sterilities, indicating that there is a hormonal influence. I hesitated to call this condition hypothyroidism. I don't know what it is, it seems to be an entity, which responds to thyroid or iodine medication. I never give thyroid extract or iodine without a careful study of the basal metabolism. I consider it reprehensible

sible to give thyroid to any case of sterility unless the basal metabolic rate justifies its use, and furthermore the rate must be controlled from time to time so that the medication can be regulated.

DR. ALFRED BAKER SPALDING, San Francisco, Calif., read a paper on **Hemostasis in Vaginal Hysterectomy for Procidentia** (The Ligation of the Lateral Vesicouterine Ligaments for the Control of Hemorrhage in Vaginal Hysterectomy for Conditions of Prolapse of the Uterus with Cystocele). (For original article see page 655.)

#### DISCUSSION

DR. J. WESLEY BOYCE, WASHINGTON, D. C.—Hemostasis should be thoroughly practiced but there are different methods of securing it. In doing vaginal hysterectomy for cystocele, prolapsus and procidentia I have followed the plan to secure hemostasis with a modification perhaps of the Mayo procedure, namely of making a T shaped incision in front of the cervix in the anterior vaginal wall and not separating back far enough on either side to involve the uterovesical ligaments, carrying the incision as near the pubic region as necessary. This is more necessary in the case of the prolapsus of the urethra than in the case where there is no prolapse. Before entering the peritoneal cavity, I first make an opening into the culdesac of Douglas. Dr. Spalding said, I think, that he does that last, but I do it first. Then I open the peritoneal cavity, anteriorly dissecting back the thin flap. Next I bring down the fundus of the uterus put on a broad clamp as close to the uterus as possible including fallopian tube, ovarian ligament, the whole of the broad ligament, the uterosacral and uterovesical ligaments. It may be necessary to use two clamps, but generally one clamp is sufficient on each side. The two sides are brought together by a sewing machine lock stitch so that every part of one side is approximated to the other side. There is none of either lateral stump that is not included in the body of this suture material. Then bringing the upper part of that suture line forward it is sutured at the junction of the urethra with the bladder. If there is a urethrocele the dissection is carried forward so that I can get a bite on the periosteum just a little to the side and behind the pubic arch. Two sutures are placed on either side in this broad ligament shelf that has been constructed securing it anteriorly. Another suture may be necessary. For the two side sutures and the midline one I have used strong chromic catgut. The vaginal mucosa from side to side is united to protect the fascial layers. We have always one weak point here. We have built up a strong shelf anteriorly but we do not know yet, unless we have unusually strong uterosacral ligaments, whether we shall get a strong pull upward and backward. If these ligaments are torn away from the sacrum, we cannot repair that injury by the vaginal route. This is always a weak point in the vaginal operation.

In the posterior operation the all important thing is to be sure that you get the fascia from the two lateral sides brought in in front of the rectum. Next in importance is to pull the rectum upward to obtain a good pelvic support, provided the uterosacrals are strong. We are going to have some failures in this procedure, although I believe they are small, at least they have been with me, but they are largely due to inefficiency of the uterosacral ligaments.

DR. ROBERT T. FRANK, NEW YORK CITY.—You might be interested in the two cadaver dissections which I made some years ago in which these ligaments can be viewed from above. I would suggest that they be called the pubouterine ligaments because that describes the attachment on both sides. I do not consider myself competent to discuss Dr. Spalding's technic because I do not do vaginal

hysterectomy for prolapsus. I think that if we have preserved the uterus in a prolapse operation in case of recurrence, we are in a much better position to do further work than after the uterus has been removed. I would like to know what the indications are for selecting vaginal hysterectomy. In my material there are a number of cases in younger women where prolapse has occurred and in which I would hate to sacrifice the uterus.

In my cases from 1925 to the present time I found that out of 180 cases of repair, there were 56 cases of prolapse in which 42 ventral fixations were performed and 5 Alexander's. The Alexander operation is done in those cases in which the abdominal wall is unduly flaccid and therefore would allow a certain amount of sagging in the erect posture. In some cases the cystocele predominates, in other cases the rectocele. I am very often able to cure the rectocele rather than the cystocele. In the cystocele I use my own technic. My main object is to preserve the pubocervical (uterine) ligament. I do not separate the bladder as extensively from the fascia as Rawls does. We think it is important to preserve the vascular layer. The fact that all of us have a certain number of recurrences of the rectocele or the cystocele shows that no technic is as yet perfect.

DR. GEORGE GRAY WARD, NEW YORK CITY.—As to the hemostasis: I long ago learned from Dr. J. Riddle Goffe to put a ligature at the base of the uteropubic fascial ligaments to control the bleeding. It is an important point in the technic. Personally I object to the term "high rectocele" because I think in a great many of these cases it is not truly a rectocele but is really an enterocele, a hernia in Douglas' pouch. A failure is very often due to this fact. Therefore my technic in these operations is, after removal of the uterus to dissect out this peritoneal sac. You can then see the uterosacral ligaments and it is not difficult to unite them with linen sutures. By this procedure the liability of a hernia forming from above is eliminated. We have proved this by our follow-up in the majority of cases. We have some failures and those are due, as Dr. Bovée has pointed out, to the fact that the uterosacrals are so weak that they cannot provide sufficient support. Follow-up shows that our percentage of failures is small, and it is always only a small hernia that forms.

The operation of Dr. Spalding procures a proper pelvic floor and particularly takes care of the rectum by lifting it up. I believe I coined the word "rectopexy" for a procedure in which the rectum is lifted up and fastened to the undamaged part of the vagina where the fascia is intact. So far as the anterior vaginal wall is concerned we can cure practically all cystoceles but the weak point in these operations lies in the fact that the uterosacral ligaments may be attenuated and inefficient as support.

DR. R. M. RAWLS, NEW YORK CITY.—All of us get equally good results in operating for prolapse if our technic is based on an anatomic repair of the injury. In doing operations for prolapse an understanding of the anatomy is essential, especially when dealing with younger women. In the woman well past the menopause extensive dissection is contraindicated and restoration of the anatomic function not necessary. In selected cases of this class I still do a Watkins' interposition operation.

Looking from above into the pelvis we see fascial bands extending out into the base of the broad ligament, and here I would differ from Dr. Spalding and would call these the cardinal ligaments rather than the lateral vesical ligaments. On a lower plane are the secondary lamellae of the pelvic fascia—the vesical or lateral vesical ligaments, the rectal and the rectovaginal layers.

In my operative work I do not make the T-incision for unless one is very careful one is apt to cut the supporting structures. I make an incision from the meatus to the cervix, through the thickness of the anterior wall and demonstrate

the bladder which is pushed off from the underlying tissues by blunt dissection. Next by sharp dissection, for a short distance, on either side the fascia is separated from the vaginal mucous membrane when a definite line of cleavage is reached and the supporting structures are demonstrated. On the posterior wall a somewhat similar method is done in first identifying the rectum. My method in dealing with prolapse is, to do an anatomic repair in women in the childbearing period, a vaginal hysterectomy and anatomic repair in women in the early menopause, and a Watkins' interposition in elderly women or those not physically suitable for extensive dissection.

In high rectocele I appreciate Dr. Ward's work on enterocele—it is now my custom to look for enterocele and where it occurs to obliterate the culdesac and repair the injury to the vaginal vault as well as the injury to the anterior and posterior walls.

DR. JOSEPH L. BAER, CHICAGO, ILL.—Just a word to continue Dr. Rawls' thought. I believe that in most cases of prolapse there is a congenitally deep pouch of Douglas and, therefore, in accordance with what Dr. Ward said, the thing to do is to obliterate the bottom of the pouch.

DR. ALFRED B. SPAULDING (closing).—I have never seen the cystocele cured at the time of operation by the Mayo technic, and if it is not cured then I cannot see why you do not always have a recurrence. I do not believe you can cure the cystocele without exposing the bladder, ligating separately the uterovesical ligaments and getting the bladder up out of the way. I do not believe it is possible to prevent recurrence by including in a mass ligature the uterovesical and the broad ligaments and then sewing the stumps under the bladder, because the cystocele is below this point.

In regard to what we do for recurrence after some one has done a vaginal hysterectomy: I do not know of anything more disheartening than to attempt the repair of these cases. I have at times succeeded in making a transverse incision through the scar at the vault of the vaginal wall, separating the bladder again and overlapping the fascia. Unfortunately, the fascia was often found to be atrophied and the result has not been good. One cannot get a good result unless the surgeon has supported the bladder at the time he did the vaginal hysterectomy.

The question has been asked as to when we take the uterus out. We do not take it out if it is very large, because we have found that it is dangerous to do extensive repair work below and then to open the abdomen and do a hysterectomy. I would prefer to do the vaginal work first and the secondary operation some time later.

Dr. Ward's reference to the deep culdesac is an important point. He has shown us how to take care of that properly.

Dr. Rawls spoke about the cardinal ligaments. To my mind there is no such thing as a cardinal ligament. One finds condensations around the blood vessels and around the ureters and nerves but they are not ligaments. I believe in all our plastic work we must use the principle that if we are to improve the posterior support we must suspend the posterior vaginal wall on the broad and the sacro-uterine ligaments.



# OBSTETRICAL SOCIETY OF PHILADELPHIA

STATED MEETING JANUARY 7, 1926

DR. BROOKE M. ANSPACH IN THE CHAIR

DR. JOHN C. HIRST, 2ND, read a paper entitled **Suppression of Urine in Connection with Pregnancy.** (For original article see page 673.)

## DISCUSSION

DR. PHILIP F. WILLIAMS.—The inability to void urine in most pregnant women is easily explained by retroversion of the uterus in early pregnancy; in late pregnancy by impaction of the head, and by toxemias from the congestion which occurs during eclampsia. The cases that Dr. Hirst has reported are rather unusual and much more interesting. In the 12 cases of suppression of urine in pregnant women that Rolleston observed, in which autopsy was done, there was a history of previous underlying nephritis, and he does not believe that acute nephritis occurs except in the woman who has had previous kidney disease. In eclampsia where the urine is almost entirely suppressed before death, the kidney picture is much like that of an acute necrosis of the cortex. I recollect two such cases.

DR. GEORGE W. OUTERBRIDGE.—I should like to mention a case showing to what degree kidneys recuperate from an intense toxic condition. Some years ago I had a case of poisoning from a mercurial douche in which the woman was completely anuric for about fifty-four hours and had 260 mg. of blood urea nitrogen. This woman was pregnant and had taken the douche for the purpose of bringing on an abortion, which she accomplished. We decapsulated both kidneys, and after a stormy career with many complications this woman eventually recovered. She was in the hospital from the end of May to the middle of September. (See *Journal American Medical Association*, Jan. 13, 1923.) The interesting feature in this case was that about a year later this woman became pregnant again. I was anxious to see how those kidneys, which had been subjected to that terrific breakdown and anuria for over fifty hours, would now carry on through a subsequent pregnancy. She entered the hospital and had careful blood chemistry studies made, which showed perfectly normal conditions. We sent her in with the idea of interrupting the pregnancy, but this was not done. She had some vomiting, which she eventually got over, and went through the pregnancy satisfactorily and eventually was delivered of an entirely healthy child. She is apparently an absolutely healthy woman today. I think this case is of interest in showing that kidneys that have been subjected to tremendous toxic conditions can recover, in a comparatively short time, to a state where they will carry through in pregnancy.

DR. EDMUND B. PIPER.—The introduction of mercurochrome in the vein, will in the fulminating type of sepsis cause acute suppression of urine. I have reported thirteen such cases followed by death. I don't believe that mercurochrome should ever be given when there is evidence of acute nephritis.

DR. B. C. HIRST.—In these cases one should endeavor to make a diagnosis between apparent and real anuria. That was the problem which presented itself in the cases reported. Apparent anuria is diagnosticated by ureteral catheterization. One may draw a pint of urine out of the pelvis of one kidney in a woman apparently anuric. The commonest cause of a real anuria is mercurial poisoning.

DR. HIRST (closing).—In answer to Dr. Outerbridge's question, the pronounced hydronephrosis on the left side was quite recent. At six months it was not very noticeable, but there was some dilatation in the left pelvis. A month later, after leaving catheter in the left ureter on three occasions, the condition was practically cured when the patient was discharged, the left kidney holding only a moderately increased amount of urine over the normal.

DR. WILLIAM R. NICHOLSON read a paper entitled **Certain Observations Regarding Prolongation of Pregnancy.** (For original article see page 745.)

#### DISCUSSION

DR. RICHARD C. NORRIS.—This very conservative presentation is to be commended. In France and Austria 300 days is given as the legal limit for full term. In England and this country it is based on a study of the individual case. The trend of modern physiology is that conception really begins during the week preceding the missed period, but the time of expected confinement has been based upon the last menstrual period, a time when we know the woman is not pregnant. Dr. Nicholson should not stress the cow as a standard for studying women. The sex of the newborn cow has been determined very accurately by studies of the maturation of the ovum and regulating the date of impregnation. Not so with the woman whose ovum does not mature in a similar manner and in whom the date of impregnation cannot be regulated. A woman does not, as a rule, go very much over time or fall into labor very much ahead of time, without an explanation for it. There is, however, such a thing as prolongation of pregnancy, and there is such a thing as danger to mother and child from this condition. It was interesting to look over records in the Preston Retreat as related to this subject. In the first 5,000 cases of my service, in which we seldom induced labor for prolongation of pregnancy, there were 140 cases of induction (2.8 per cent). Of these, only 15 were for prolongation of pregnancy; that is once in 333 cases. As my experience grew I found many difficult labors, with high forceps and overgrown babies with extensive lacerations, sometimes partially detached placenta, in the cases permitted to go too long beyond calculated term. I then made it a rule not to permit a case with a floating head to go more than ten days beyond carefully calculated term. In the last 1500 cases we have induced labor 88 times for all causes (5.8 per cent), and 24 times for prolongation of pregnancy, or 1 in 63 cases. Studying the infant mortality in which we induced labor for prolongation of pregnancy, we found a marked improvement. In two cases labor was induced on dead babies, due apparently to prolongation of pregnancy. Just today a woman thought she was at her term, but after careful study of her history we concluded that she was probably about three weeks overdue. Yesterday she was in labor all day and her baby was dead. To deliver the shoulders, amputation of both arms was necessary. The baby's weight was nine pounds and fourteen ounces. That woman had given birth easily at term to other babies weighing 7½ and 8 pounds. One has to make some fixed rule for guidance,—a time beyond which one will not let patients go without the careful special study that Dr. Nicholson has outlined. My rule now is ten days. First, we consider an accurate history as to menstruation and fetal movements. The more uncertain the history the more uncertain is the conclusion in that particular case. Second, as to the size of previous children and the character of previous labors, if a multipara, with the presumption that each child up to the fourth will probably be progressively larger. The size of the pelvis must be accurately known. The stature and size of the father's head. Is the patient an elderly primipara? Is the position occipitoposterior, resting high at the brim, incompletely flexed and with no descent into the pelvis? Is it a breech?

Such cases are prone to prolongation of pregnancy. The oftener I see a woman in the ordeal of labor the more I am convinced that her nervous system is a very important factor as to how her uterus will function and to what extent pain will inhibit uterine function. As some women vary in their ability to digest a meal, so the uterus may vary in its function during labor. The proper functioning of the sympathetic nervous system is of the greatest value. When it fails it may make her obstetrically unfit. Prolongation of pregnancy often occurs in this type. The modern, neurotic, nerve-stressed girl of ultrafashionable life, when labor begins, often goes to pieces, and you have to resort to narcotics and anesthetics early and more often deliver with forceps after helping dilatation by some mechanical means. When this type is allowed to go too much overtime, all these difficulties will be magnified. Now what is the danger of inducing labor for a woman who has gone ten days over her time, in whom you find, after this critical study, some of these conditions to make you believe that she has rather a difficult labor ahead of her? Naturally, infection is thought of as the greatest danger. In all my experience I have seen but two women die from sepsis following induction of labor, and they died after induction of labor done by someone else, and subsequently I was called upon to operate—on one of these a cesarean section. I have never had a patient die after induction of labor done by myself for prolongation of pregnancy. The inherent dangers are dependent entirely upon the one who does it; his technic and the subsequent handling of that case. Once in 300 cases prolapse of the cord has jeopardized the fetus. There is, of course, a greater degree of aseptic technic required in induction of labor and delivery of the patient than in a normal delivery. I think it is often apparent to those who have a wide experience that patients who go ten days or two weeks over the calculated time often have large babies, with large well-ossified heads, with more obstetric complications and more skill required at delivery. I often say, I think if nature permitted the modern woman to have her babies at eight or eight and a half months it would save a lot of trouble. I believe that prolongation of pregnancy has its added dangers. If I have a primipara and she goes ten days overtime, the head not fixed in the inlet, and especially, if she has a high posterior occiput; if she is not obstetrically fit; if her pelvis is on the border line as to size, I usually induce labor by the simplest means at my disposal. I think Dr. Nicholson has overestimated the value of measuring the head with a pelvimeter. I would rather depend upon palpation of the head overlapping the symphysis and the accurate measurement of the pelvis than to hope to reach a conclusion by attempting to push the head into the pelvis.

If the patient goes ten days beyond the calculated period, suppose there has been an error in her menstrual history and suppose we make an error of acting two weeks too soon, the infant will not be endangered. In multiparas there is a wider field for interfering even more promptly. The woman who has had one or two normal labors comes to term with the head riding high above the pelvic inlet, perhaps a posterior occiput, and her pregnancy is prolonged. She gets nervous, her family is nervous, her body chemistry is under stress, she sleeps badly, and daily she becomes less fit, obstetrically, for her labor. It has been as much to my comfort as to my patient to have her enter a well-equipped hospital and, after taking a large dose of castor oil, the following day, under strict aseptic precautions, to dilate her cervix with two fingers, gently detach the lower pole of the fetal sac and give her five minims of pituitrin. The intermittent dilatation is continued for twenty minutes. With few exceptions, labor begins. Anything that makes labor easier for the woman, she deserves to have. Bringing on labor in a hospital properly equipped is not to her detriment, as I have done it over and over again; and as my practice and my experience has grown I have resorted to it more and more. I do not wish to convey the idea that I believe in confinement by appointment: but I believe that, with hospital equipment, if these cases of prolonged pregnancy are so treated, instead of waiting perhaps two or three weeks for Nature, the obstetrician is not taking ad-

vantage, for his patients' real benefit of the good things that have come out of the past and is clinging to what I believe is behind the times.

DR. GEORGE M. BOYD.—I believe that it is exceedingly rare for a woman to go over the normal length of gestation. In cases where the pregnancy seems to be prolonged, it is usually an error on our part brought about by our inability to determine just when conception took place. I agree with Dr. Norris that we should study carefully the patient as she approaches term and note any feto-pelvic disproportion. One objection to the Müller test is that it often necessitates full anesthesia. I do not believe in the routine induction of labor at term as has been recommended. To follow out such a course will invite trouble, for the methods of inducing labor are not always satisfactory. When feto-pelvic disproportion exists, a test of labor is invaluable, for a normal labor with a large infant is apt to be safer than an induced one with a smaller infant.

DR. CHARLES MAZER.—Regardless of whether the unborn baby is postmature or two weeks short of term, if, in our opinion, the head as compared with the inlet of the pelvis is growing too large, it is our duty to prevent damage to mother and baby by inducing labor as near term as possible. Whether we use the classical methods of gauging the size of the head or a method of our own, we can easily foretell a tendency to overgrowth. I induce labor in these cases by giving castor oil, quinine and pituitrin, which is successful in six out of ten cases. In the unsuccessful cases I let nature take her course rather than resort to instrumental induction of labor, because I honestly believe that a version or even a cesarean section is no more hazardous to mother and baby than instrumental induction of labor.

DR. NICHOLSON (closing).—Dr. Piper is perfectly correct when he speaks of the early ossification of the sutures in fontanels and, as I said in my paper, I thoroughly agree that such cases are often not postmature at all. It has been proved that the x-ray will not help in determining the question of maturity, based upon the condition of the sutures in fontanels. I am also thoroughly in accord with Dr. Boyd's disinclination to induce labor without very definite indications. I think it is a grave mistake for any Society such as this to go on record as advocating either the routine induction of labor at term, or the induction of labor without very definite indications, and the whole purpose of my paper was to call attention to the fact that postmaturity of the unborn child is a much more rare condition than is supposed. I fully believe that if the general profession should undertake to induce labor as a routine procedure, there would be a very unfortunate increase of morbidity and mortality. I have no special objection to the surgically trained obstetricians' adoption of the plan of routine induction, though I personally believe it is an uncalled-for procedure, but this is a totally different question when the general profession is advised to interfere in pregnancy, either because the earliest estimated date for the delivery has been passed, or because it is more convenient to the doctor and the patient that labor be brought on at a certain specified date.

DR. CHARLES S. BARNES read a paper entitled *Occipitoposterior Position*. (For original article see page 734.)

#### DISCUSSION

DR. JOHN C. APPLEGATE.—I am convinced that nothing gives rise to greater traumatism, both maternal and fetal, than the conduct of delivery with the diameters of the head in the pelvis not properly correlated, as in the occipitoposterior position. With regard to the frequency of the occipitoposterior position, I am very sure that 25 to 30 per cent of the cases I see are occipitoposterior positions and

require interference. The next point is the early recognition of this anomalous position. It is not unusual for us to hear that "the forceps have slipped" and nine times out of ten, they have been applied to a head in an unrecognized occipitoposterior position and the tenth is perhaps a hydrocephalic head or some other pathologic condition. I have in mind at this moment a patient whom I saw not long ago where three physicians had attempted to deliver with forceps. The woman had a relatively contracted pelvis and the child was in an unrecognized occipitoposterior position; each physician took a turn and the instruments in each instance failed to hold; the third doctor was a big, husky fellow and he perhaps got a better grip on the head than the others. When he pulled something had to give way, with the result that there was a dead baby, complete laceration of the perineum, and infection of the woman. The early recognition of this condition is most important. The fetal heart sounds, the palpation of the fetal back and small parts are fairly reliable diagnostic signs, but not absolutely reliable; the fontanels and the suture lines are very reliable, although errors arise oftentimes. When labor is not progressing normally I have no hesitancy in introducing enough of the hand to palpate an ear or the nape of the neck, to be sure of the position before any attempt at delivery is made. In regard to the methods Dr. Barnes referred to, manual rotation is a thing that we usually succeed in doing. I have always felt that the lower the head is in the pelvis the easier it is to rotate; if a right occipitoposterior, the left hand or as much of it as necessary, with the thumb down, is introduced, and kept on the right side of the baby's head so that the occiput and thumb rotate forward in the same relative position, pressure at the same time being made on the forehead just above the pubis with the other hand. It is absolutely useless to rotate the head unless you have the assistance of someone to rotate the body of the child at the same time, otherwise it swings back into its original position; then the application of forceps is necessary when spontaneous delivery does not take place. We have applied forceps in the reverse position, but not with the view of rotating the head, but rather to hold the head and rotate it while the body is being rotated. With the application of forceps simply for the purpose of rotating the head, incalculable damage may be inflicted upon the baby. I am always apprehensive about doing version with the occipitoposterior position because it is more difficult to estimate the comparative dimensions between the head and the pelvis in the occipitoposterior position than in the occipitoanterior position.

DR. BARTON COOKE HIRST.—The best method of dealing with occipitoposterior positions, is always to deliver them by the Scanzoni maneuver. It requires only half a turn of the wrist, without the exercise of any force, if the rotation is done at the right time, namely, when the greatest head diameters are out of the bony pelvic outlet and the scalp appears in the partly dilated vulvar orifice. There is a type of contracted pelvis with diminished width in the outlet in which it may be desirable to apply the Scanzoni method in reverse. If one attains skill in this maneuver by practice on the mannikin and the living subject he soon comes to regard an occipitoposterior position as no complication at all.

DR. J. O. ARNOLD.—I am in entire sympathy with the statement, that the more or less frequent occurrence of persistent occipitoposterior positions is no longer a matter of any serious concern because of the ease with which Dr. Hirst can dispose of them. I feel the same way, but I have arrived at my feeling of safety in the handling of these cases, from an experience quite different from that of Dr. Hirst, because I know I can quickly and safely rotate the occiput manually. Manual rotation is a safer method to teach to beginners and to men of limited experience on obstetrics. It is certainly attended with less danger to both mother and child in the hands of those who are not experts, than instrumental rotation, or most other methods that have been proposed.

In a recent review of 400 consecutive deliveries in private and consultation prac-

tice, there were 98 cases of persistent occiput posterior,—almost 25 per cent. This may be slightly higher than the normal percentage of occurrence, because many of these were consultation cases, but I am inclined to think it is not far from correct.

Some years ago, in a paper describing what I styled the “trimanual method of rotating the occiput,” I noted that out of 200 deliveries done for other physicians, 50 or one out of every four, were persistent occipitoposterior positions.

This “trimanual method” was successfully used in all those fifty cases, as well as in the 98 of this recent series, and has been routinely used in scores of other cases not included in these groups.

There must, of course, be absolute certainty as to diagnosis and relationships, and then there must be complete anesthesia for a few minutes, which will permit the manual rotation of the head and body at the same time. The hand of the assistant will keep the body in place, and thereby prevent the return of the occiput to its faulty position. I see no reason whatever for the maneuver of Dr. DeLee to keep the head in place by grasping the scalp with a tenaculum forceps.

It is not only unnecessary, but inadvisable to try to grasp the head with the whole hand introduced into the vagina. Simply applying the fingers of one hand to the occipital pole of the head in the vagina, while the fingers of the external hand make suprapubic pressure on the frontal pole—with the assistant swinging the body—will accomplish rotation safely and easily. Any head that will come down into the pelvic cavity, can thus be manually rotated in the pelvis, and one that does not come down, does not belong to the class of persistent occiput posterior, and therefore calls for other treatment.

DR. LEONARD AVERETT.—I very much regret to see that the writer has overlooked the Kielland forceps in the treatment of occiput posterior. You can apply it in any position, which eliminates the manual, or Scanzoni maneuver, and it will not slip.

DR. DANIEL LONGAKER.—This is the class of cases with high fetal mortality, from the ill-judged procedure of forceps application much too early. It requires an unusual degree of skill, and if the parts be not quite dilatable there will surely be a paralyzed or a dead baby. The thing to do is to give some morphia and wait sufficiently long, until the cervix is out of the way and entirely dilated so that it offers no resistance whatsoever, and then do a version. On the basis of between two and three thousand versions done within the last four or five years, I can speak authoritatively on the subject and I think there is no way by which these cases can be so satisfactorily handled. I have used the Kielland instrument with considerable satisfaction.

DR. BARNES (closing).—I believe that the operator should treat the case by that method best adapted to the condition or to the operator's skill. One man can do manual rotation, in most cases, another can more frequently succeed best with forceps rotation.

The point I wanted especially to emphasize was early diagnosis; not to let the case drag wearily on without knowing the condition present. This is often done. It is most important that the diagnosis be made in the first stage of labor, not allowing the case to go unrelieved for an undue length of time, whether relief be given by manual rotation and spontaneous delivery or forceps extraction, or by forceps rotation and delivery, or by version and extraction. The method may depend largely upon the man or probably much upon the individual case.

We all agree that there is room for improvement over present-day obstetrics. I personally do not have quite the equanimity, in dealing with occipitoposterior, that some of my colleagues seem to have. I think that, according to the literature and my observation and yours, there is a large mortality of infants and much maternal morbidity due to this common anomaly.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Collective Review

### HYPERCHOLESTEROLEMIA DURING PREGNANCY

BY C. F. FLUHMANN, M.D., C.M., SAN FRANCISCO, CALIFORNIA

SINCE the development of efficient chemical methods for determining quantitatively the amount of cholesterol present in the blood, great interest has centered on the subject, and during the past fifteen years the medical literature has been flooded with numerous articles on this problem. The many observations that have been reported have brought to light much information on its occurrence in various diseases, on the rôle it plays in infection and immunity, and also on certain pathologic processes which it can itself set up. A great deal remains obscure, however, regarding its exact position in normal physiology, and this especially holds true respecting its presence in unusual amounts during pregnancy. The following review is an attempt to summarize the most important work that has been done on the subject and as far as possible to correlate the findings.

The occurrence of a hypercholesterolemia during the latter months of pregnancy and its disappearance immediately after delivery was first described, in 1911, by Neumann and Hermann,<sup>1</sup> and soon after by Chauffard and his school.<sup>2</sup> This fact has been corroborated by many workers since then, among whom may be mentioned Autenreith and Funk,<sup>3</sup> Klinkert,<sup>4</sup> Huffmann,<sup>5</sup> and Schiller.<sup>6</sup> Other observations also revealed that in this increase both the free cholesterol and the cholesterol-esters take part (Hermann and Neumann,<sup>7</sup> Slemmons and Curtis,<sup>8</sup> Bloor and Knudson,<sup>9</sup> Slemmons and Stander<sup>10</sup>). Again, it was shown, in 1912, by Hermann and Neumann,<sup>11</sup> and later by Slemmons<sup>12</sup> and Slemmons and Stander,<sup>10</sup> that this was not an isolated feature, but that it was accompanied by an increase in the blood of closely related substances, namely, neutral fat and lecithin.

#### EXCRETION IN THE BILE

One of the first problems that was attacked by early workers was to determine whether the increase of cholesterol was due simply to a retention in the body or to an increased production. Since normally most of the cholesterol absorbed is excreted in the bile, this was very soon taken into consideration. McNee,<sup>12</sup> in studying three patients who had died during the last trimester of pregnancy, found a very marked increase in the amount of cholesterol excreted in the bile, and hence came to the conclusion that this figure rose with that of the blood values. Chauffard et al.,<sup>13</sup> however, demonstrated that ligating the common bile duct in six dogs caused an intense hypercholesterolemia in each case. Later, Baemeister and Havers,<sup>14</sup> in further experi-

mental work with dogs in which they had produced biliary fistulae, made a series of estimations on the cholesterol content of the bile and found a very considerable decrease in the amount of cholesterol excreted by that channel during the last month of gestation. From this they evolved the theory that the hypercholesterolemia of pregnancy was caused by a retention, a damming back by the liver cells, and not by an endogenous overproduction of the substance. Medak and Pribram,<sup>15</sup> using specimens of bile obtained from human beings by means of a duodenal sound, found that the cholesterol content of the bile diminished from month to month during pregnancy until in the ninth month only very small quantities could be detected. They reported that this fact was also true in those cases of hypercholesterolemia occurring in conjunction with cholelithiasis, nephropathies, hypertrophic liver cirrhosis, icterus catarrhalis and diabetes. This work in regard to pregnancy was further corroborated by E. E. Pribram.<sup>16</sup>

#### GLANDS OF INTERNAL SECRETION

It was never considered, however, that the conception of a simple damming back by the liver was a sufficient explanation and there have been a great many attempts to show that cholesterol metabolism is under the control of the endocrine glands. Neumann and Hermann,<sup>1</sup> in their original work, reported the occurrence of a lipoidemia during the menopause, the postclimacteric period, following castration (both in animals and in human beings), and in experimental animals following exposure of the ovaries to x-rays. From this they assumed that in pregnancy there is a functional alteration in the sexual glands which leads to an excessive formation of cholesterol. Although Hufmann<sup>2</sup> felt that menstruation did not influence the cholesterol curve, Shiskin<sup>17</sup> has more recently noted a considerable increase associated with the onset and first two days of menstruation. There is also evidence that the thyroid has some influence on cholesterol. Troisier and Grigaut<sup>18</sup> and later Rémond and Columbiès<sup>19</sup> having demonstrated that thyroidectomy caused a hypercholesterolemia, and Leupold and Seisser<sup>20</sup> were able to lower the blood cholesterol of rabbits by the injection of thyroïdin.

But the main interest has centered on the suprarenal and this is particularly important in regard to pregnancy owing to the changes in that gland at this time. Two definite opinions have arisen on this question and they are in direct contradiction. The French school, headed by Chauffard and his coworkers, having noted that the cortex of the suprarenal, of all the tissues of the body, is the richest in cholesterol, have sought to prove that this organ is the most important factor in its production. They claim that cholesterol is actually manufactured by the suprarenal glands and that they are supplemented in this function by the corpus luteum during certain periods, particularly in its regressive phases.<sup>21, 22</sup> In this they have been supported by Albrecht and Weltmann<sup>23</sup> who also believe that increased activity of the suprarenals results in an increase of cholesterol in the blood. Troisier and Grigaut,<sup>18</sup> in support of this theory, showed that unilateral suprarenalectomy in dogs was followed by a transitory hypercholesterolemia after a latent period, and that bilateral suprarenalectomy did not produce this during the short period that the animal survived. Porak and Quinquaud,<sup>24</sup> in studying the cholesterol content of the blood issuing from the suprarenal vein and comparing it with that in the blood of the general circulation (femoral vein,



carotid artery), found considerably more cholesterol in the suprarenal vein, and hence assumed that the difference was due to amounts added to the blood in its course through the gland. The findings in a case of suprarenal adenoma, reported by Yovanovitch,<sup>25</sup> where a high cholesterolemia was present, were taken to indicate an effect similar to a hyperfunction of glandular tissue and thus to strengthen the theory. Laroche,<sup>26</sup> in studies on hypercholesterolemia in nephritis, also supported this idea. In regard to the effect of adrenalin, Wacker and Hueck<sup>27</sup> early reported that in one instance they found a hypercholesterolemia associated with a hyperglycemia four hours following the injection in a rabbit of 4 c.c. of a 1:2000 solution of adrenalin, and Alessandri<sup>28</sup> produced an increase of blood cholesterol in eight out of ten patients half an hour after the injection of adrenalin.

The above views, however, have met with a great deal of opposition, mainly from German experimenters headed by Aschoff and his pupils. Landau,<sup>31</sup> in studying numerous sections of suprarenal glands in various conditions, came to the conclusion that their lipid content was directly dependent on the lipid content of the body. That is, the suprarenals do not manufacture cholesterol but act as depositories and hence their content varies more or less according to the amount present in the blood. This was further supported in experiments by Landau and McNee<sup>32, 33</sup> who fed rabbits large amounts of cholesterol and found both a hypertrophy of the suprarenal cortex and an increase in its cholesterol content. Rothschild<sup>34</sup> noted a hypercholesterolemia following unilateral suprarenalectomy, but since he obtained similar results when he removed both glands he opposed the idea that they form cholesterol. Baumann and Holly<sup>35</sup> also came out against the French conception when they were unable to produce any significant change in the blood cholesterol of rabbits by suprarenalectomies. Sternberg<sup>36</sup> has noted a great similarity in the histologic changes of the suprarenal cortex incident to pregnancy and in cholesterol-fed animals, and attributes both conditions to the same primary cause, namely, hypercholesterolemia. Finally, Steinitz,<sup>29</sup> and Joelsson and Shorr<sup>30</sup> report that they have been unable to affect the cholesterol content of blood by injections of adrenalin.

Joelsson and Shorr<sup>30</sup> more recently have studied the subject and also obtained an increase in the blood cholesterol of rabbits following the removal of one or one and a half suprarenals. They are opposed to both the French and German ideas and suggest the possibility that the internal secretion of the suprarenal has some effect on the blood cholesterol similar to that of the pancreas on the blood sugar.

#### TOXEMIAS OF PREGNANCY

When in 1913 Bürger and Beumer,<sup>37</sup> and shortly after Autenreith and Funk,<sup>3</sup> each reported a single instance of marked increase of blood cholesterol during eclampsia it seemed as though this might offer a clue to the solution of the problem. Then two years later Huffmann<sup>5</sup> also expressed the opinion that the cholesterol of the blood was particularly increased in eclamptic patients. The question was then taken up by American investigators and Slemmons and Curtis<sup>8</sup> found that although the blood cholesterol was increased in a number of cases of eclampsia this was not a distinguishing feature as the increase in some normal pregnant women was still higher. Two cases of pernicious vomiting did not show any increase in the blood cholesterol, and in nephritic toxemias it was found to be normal or dimin-

ished. They then felt that this might be of some use in differentiating eclampsia from nephritis but further studies by Slemons<sup>38</sup> showed this to be incorrect as three cases of eclampsia had normal values. This was corroborated, in 1923, by Slemons and Stander<sup>10</sup> who came to the conclusion that no characteristic change in the blood fat or blood lipoids accompanies the development of eclampsia or allied intoxications of pregnancy. Campbell<sup>39</sup> in a recent very excellent review of the subject of cholesterol suggests that the acidosis found in the latter months of pregnancy is of importance, stating that "it can hardly be coincidence that three such different conditions as pregnancy, diabetes mellitus, and nephritis also tend to produce acidosis and a high cholesterol content of the blood unless there is some connection between these two factors." More recently Baumann and Holly<sup>40, 41</sup> have studied the blood cholesterol in pregnant dogs and rabbits. Here they noted a very different condition from that in human beings, the rabbits showing a 55 per cent decrease which could be accounted for by the cholesterol deposited in various organs, and in dogs there was very little change from the normal. They are inclined to explain the lipoidemia of pregnancy in the human being as a reaction called forth by a mild intoxication, that is, pregnancy in the human being is to be considered on a pathologic basis and in essentially every case causing an intoxication.

#### RELATION TO LACTATION

But it was inevitable that the problem should be attacked in the light of conditions peculiar to pregnancy itself, and the relation of cholesterol to lactation must be mentioned first because this is the only branch of the subject in which opposing views and directly contradictory results are not found. It has been shown by Dorlencourt and Palfy<sup>42, 43</sup> that cholesterol as such occurs in small quantities in both colostrum and breast milk and that these amounts vary under different conditions of nursing. In a paper on milk production, Meigs<sup>44</sup> relates how fat is synthesized from the phospholipins of the blood, and owing to the close relationship between lecithin and cholesterol it is quite possible that the latter may also be concerned. Hermann and Neumann<sup>11</sup> considered the mammary gland as a very important factor in the excretion of cholesterol, and found that in women, who did not nurse their babies, the lipoidemia of pregnancy persisted for a longer period after delivery. Slemons and Stander<sup>10</sup> consider that the increase of fat, lecithin, and cholesterol in the blood during the latter part of pregnancy represents a preliminary step in the preparation for lactation. Baumann and Holly,<sup>40, 41</sup> as previously mentioned, found in pregnant rabbits a decrease in the blood cholesterol and phosphatides to nearly half the nonpregnant levels. Moreover, they note that the increase of these substances in the mammary glands and smaller deposits in other tissues, such as the uterus, ovaries, etc., are sufficient to account for the decrease occurring in the blood.

#### FETAL METABOLISM

Has the hypercholesterolemia of pregnancy any relation to the fetus? Is it simply a physiologic process to supply the wants of the developing embryo? It has been definitely established that the blood of infants contains much smaller amounts of cholesterol than the mother's blood. This was first demonstrated by Chauffard et al<sup>45</sup> who estimated the cholesterol present in blood from the umbilical

cord immediately after delivery, and it has been corroborated by further studies on the blood of the newborn by many observers, notably Hermann and Neumann,<sup>7</sup> Klinkert,<sup>4</sup> Huffmann,<sup>5</sup> de Simone,<sup>40</sup> Slemmons and Stander,<sup>10</sup> etc. Slemmons and Curtis,<sup>8</sup> moreover, have pointed out an interesting fact in comparing the blood of mother and infant. They found that free cholester<sup>ol</sup> existed in the two circulations in approximately the same amounts, the difference being due to the large amount of cholesterolesters present in the maternal circulation and their almost total absence from the fetal blood under normal conditions. From this they argue that free cholesterol may readily pass through the placenta but not cholesterolesters. In addition, as an explanation of the hypercholesterolemia of pregnancy, they suggest that cholesterol may be a waste product from the fetus and so be constantly passing into the maternal circulation and cause the increase noted in the latter months. However, in considering this phase of the problem, Chauffard and his coworkers,<sup>21</sup> although they give no final conclusions, report a series of estimations on blood obtained from the umbilical cord immediately after labor. Here they found that the blood of the umbilical vein (that is, the blood flowing from the placenta to the fetus) is considerably richer in cholesterol than the blood of the umbilical arteries in which the flow is in the reverse direction. Furthermore it is very questionable whether cholesterol *can* pass through the placenta, and if so by what mechanism is it possible? Since cholesterol is a colloid it cannot pass through the placenta according to the laws of diffusion. Gage and Gage,<sup>47</sup> in 1908, injected Sudan III into pregnant rabbits and were unable to demonstrate any of the dye in the fetus, while Mendel and Daniels<sup>48</sup> in experiments with rats found that stained fat when fed to the pregnant mothers could not be recovered in the young. Schönheimer<sup>49</sup> performed a series of experiments in which large amounts of cholesterol were fed to rabbits and guinea pigs, and two of his animals became pregnant. After delivery, the placentae were noted to be very heavily infiltrated with cholesterol, but careful examination of the fetal organs failed to show any excessive accumulation of these crystals, although they were present to the same amount that a normal fetus of that age shows. These facts are taken to indicate that fat cannot pass through the placenta and hence opens up a new problem as to how the growing embryo obtains the fat that it requires. Wesson,<sup>50</sup> in studying this problem, concludes that it is able to synthesize its own fat, and Slemmons and Stander<sup>10</sup> suggest that this is possibly from the glucose which is so readily available to the fetus.

#### CONCLUSIONS

Owing to the discrepancies in the findings of different workers, it is impossible at present to reach definite conclusions regarding the significance of cholesterol in pregnancy. During pregnancy there is most likely a decreased excretion in the bile; increased activity of certain glands of internal secretion seem to be a factor in its increased production; it does not appear to have any relation to toxic conditions; it probably is not essential for the needs of the fetus, but it seems to be necessary for the production of milk. Further work on the importance of cholesterol in the physiologic economy, its relation to the metabolism of fats and other lipoids (lecithin, etc.) is desirable.

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STANFORD SCHOOL OF MEDICINE.

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## Item

### RESEARCH FELLOWSHIP IN GYNECOLOGY

A fellowship is offered by the Gyneccean Hospital Institute of Gynecologic Research of the University of Pennsylvania, to graduates in medicine, who desire to undertake investigations in Gynecologic Research.

Applicants are requested to submit a statement of their professional training, including degrees, hospital internship and experience in methods of research. Letters of reference from teachers and others familiar with the training and work of the applicant are desired.

The Fellow will receive \$1,800 per annum with a likelihood of increase subsequently.

Applicants are requested to address Dr. Charles C. Norris, University Hospital of Pennsylvania, 34th and Spruce Streets, Philadelphia.

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## Erratum

In the article by Dr. Novak entitled "The Significance of Uterine Mucosa in the Fallopian Tube, with a Discussion of the Origin of Aberrant Endometrium" in the October issue, the legends for Figs. 21 and 22 are transposed.

## Books Received

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**PRINCIPLES AND PRACTICE OF ENDOCRINE MEDICINE.** By William Nathaniel Berkeley, One Time Director of the Laboratory of Experimental Medicine, Cornell University Medical College. Illustrated with 56 engravings and 4 colored plates. Philadelphia, Lea & Febiger, 1926.

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No. 6

## Original Communications

### HOW THE PATHOLOGY OF FIBROID TUMORS OF THE UTERUS WILL DETERMINE THE SELECTION OF RADIUM OR OPERATION IN THEIR TREATMENT\*

By JOHN OSBORN POLAK, M.D., BROOKLYN, N. Y.

ABDOMINAL surgery has become so perfected, the technic of hysterectomy and myomectomy so thoroughly mastered, and the employment of radium and x-ray so widespread, that there is hardly a fibroid tumor found at examination which has not been treated, or has not had an operation advised. Yet in the light of clinical experience this advice is not justified; furthermore, the practitioner has become confused in his consideration of fibroids, their life history, their dangers, the interpretation of their symptoms, and the indications and contraindications for their treatment.

It is my purpose this evening to attempt to correlate the accepted clinical facts relative to uterine myomas:

(a) To demonstrate how they develop and grow, as well as how they live; (b) what allied conditions change the rate of their growth; (c) how and why they produce symptoms; (d) what pathologic changes these tumors may undergo; and set forth some of their dangers and complications; (e) their influence on pregnancy and labor, and finally, to describe the types of tumor amenable to treatment by radium or x-ray, the types that require surgery, as well as the form of growth which will require no treatment at all.

The fibroid tumor is the most common form of uterine neoplasm; while histologically it is benign, it possesses great potentiality for harm. Its origin is uncertain, though it is probable that fibroids develop from congenital rests, or fetal misplacements of fibrous tissue in or about the wall of the blood vessels which course within the uterine muscle. When first recognized, these congenital rests appear as solid growths which seem to be due to a proliferation of the muscular and connective tissue

\*Read at a meeting of the Brooklyn Gynecological Society, December 4, 1925.

NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

elements in the myometrium around the different rest centers. They are usually found in the uterine body as small nodules in, but not of the muscle, incapsulated and discrete. Fibroids are usually multiple, not

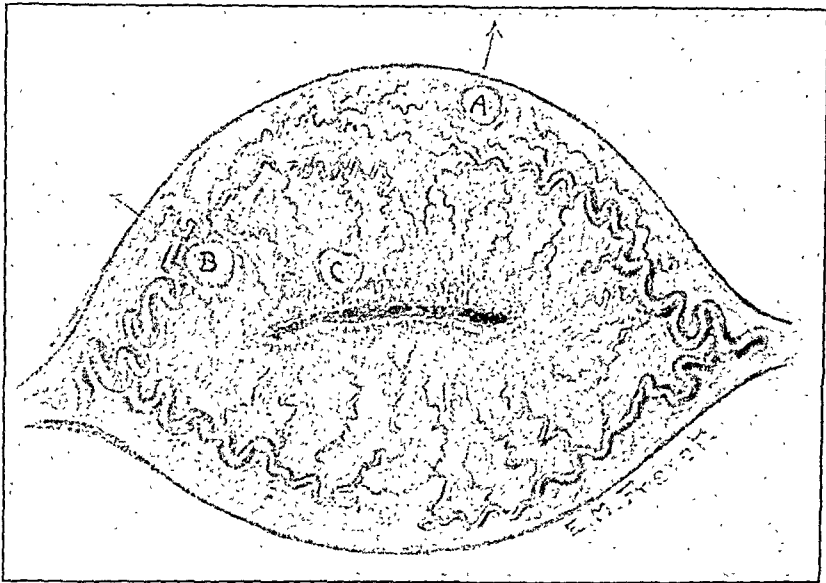


Fig. 1.—Transverse section of uterus, showing the accurate arteries and inter-muscular branches, with three intramural fibroid rests having different relations to the myometrium and uterine circulation.

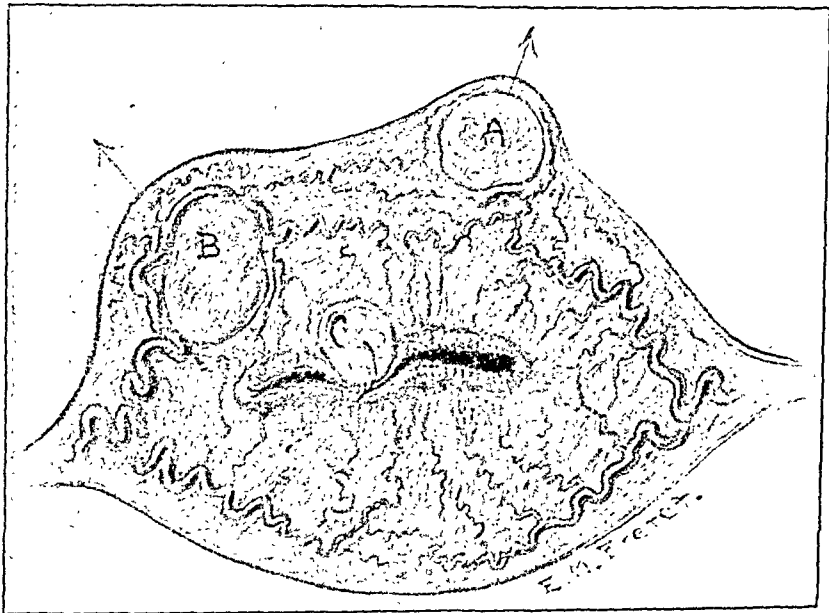


Fig. 2.—Tumor A is being evolved outward by muscular contraction becoming a subserous growth; its circulation is on the proximal side. Tumor B is developing within the uterine wall as an intramural tumor, amply supplied with blood. Tumor C is being evolved into the uterine cavity, carrying the endometrium before it, producing atrophy of the overlying mucosa.

more than 1 or 2 per cent occur singly, and their development is limited almost wholly to the period of sexual activity.

From 5 to 10 per cent of all women over thirty have these tumors; and it has been stated that a fibroid or fibroids may be found in 40 per cent of women who have reached the age of fifty.

Clinically, it has been observed that the hyperpituitary type of woman, who has an anteverted-anteflexed uterus with a relatively large uterine body from the very beginning of her menstrual life, is rather prone to develop fibroids. These patients always flow freely; they may have comenstrual dysmenorrhea, and are frequently sterile.

Fortunately, few of these tumors produce symptoms, and few attain large size, but all grow under the influence of repeated menstruation, or the stimulation of pregnancy *and all fibroid tumors bear watching.*

To appreciate their growth and development we must review certain physiologic facts. First, their relation to the uterine blood supply. Fibroid tumors begin as intramural growths, usually in the body of the uterus, with a definite relation to the uterine circulation; the mass of the

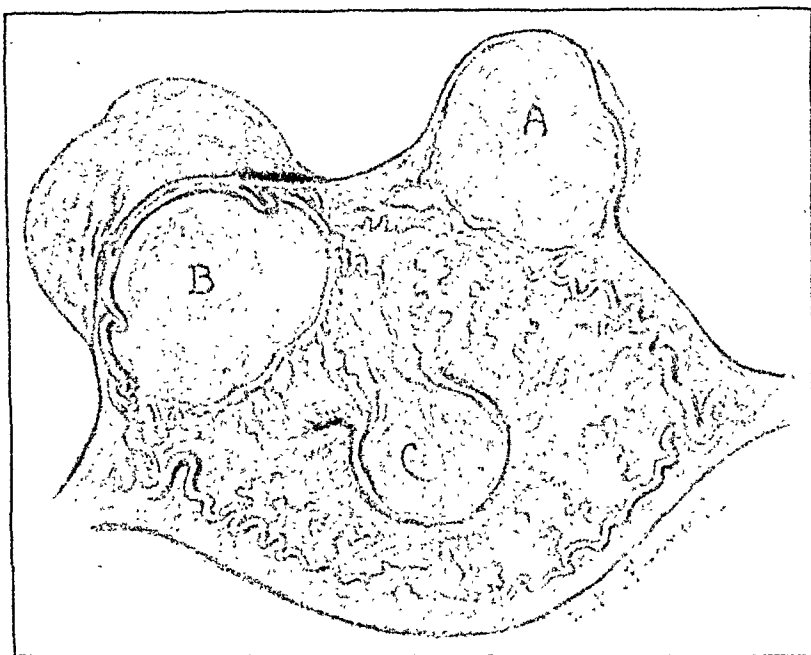


Fig. 3.—In this drawing all of the tumors have grown and have been evolved in the direction of least resistance by uterine contraction, carrying their capsules with them. C is becoming pedunculated, has thinned its overlying endometrium, distorted the cavity, and increased the area of endometrial response.

arterial and venous blood supply is found in the outer third of the uterine wall and, as the pelvic vessels have no valves the blood is propelled through them by uterine contraction. Another fact worthy of mention is that the basal endometrium and the inner third of the uterine wall have a relatively poor blood supply, for the uterine arteries and veins, ascending toward the fundus on the lateral walls of the uterus, give off the arcuate vessels which course anteriorly and posteriorly in the outer third of the uterine myometrium (Fig. 1), and these in turn break into the intermuscular branches which reach the basal endometrium as arterioles and actually terminate in the venous radicals from which the venous return begins. The paucity of the endometrial circulation is a factor in the terminal necrosis which takes place in the



atrophic endometrium covering submucous and polypoid growths. Fig. 1 shows three fibroid nodules all in an intramural position, in different relations to the circulation and with varying amounts of uterine muscle surrounding them. Each nodule will have a different rate of growth, a different life history and produce a train of symptoms dependent upon its final location and the paucity or abundance of its blood supply.

The second physiologic fact which determines the life and development of a fibroid tumor is the constant intermittent contraction of the uterus, for by these muscular contractions the tumor mass is evolved in the direction of least resistance, carrying its capsule and its circulation with it. In Fig. 2 we can see one intramural tumor being evolved outward, becoming a subperitoneal growth, and pushing its blood supply ahead of it, owing to the fact that the great mass of the uterine muscle is on the proximal side of this tumor. In the same picture we find

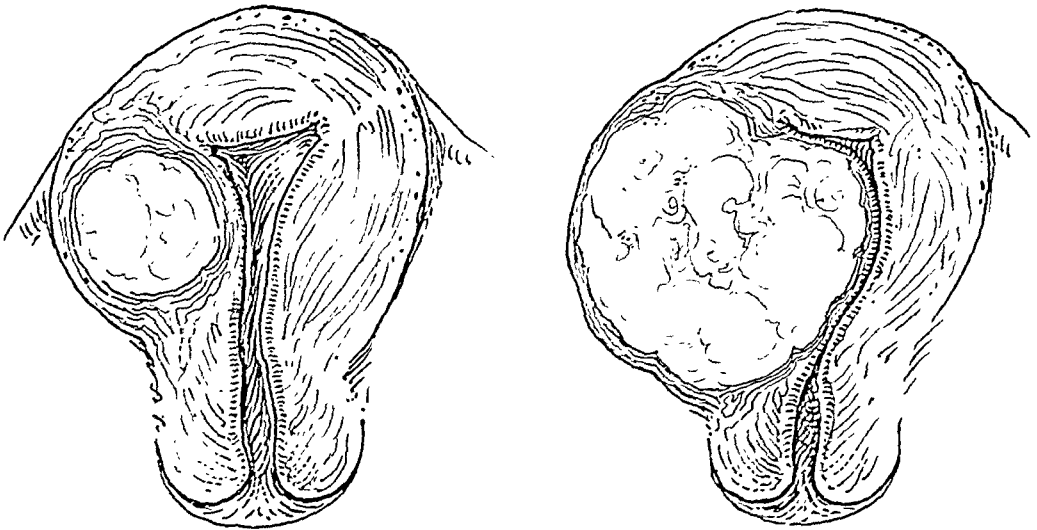


Fig. 4.—Type of interstitial growth enlarging the uterus, increasing the menstrual bleeding by increased endometrial area, lengthening and distorting the cavity. This type is best suited to radium or x-ray therapy.

another growth being evolved toward the uterine cavity, and as it is extruded the overlying endometrium becomes stretched, thin, and atrophic; the endometrial glands and blood vessels become flattened and compressed, many of the glands lying parallel to the free surface of the tumor, or they may have entirely disappeared, while the venous radicals are blocked by tumor pressure and thus enlarge, forming venous lacunae, which, as the pressure increases rupture and produce metrorrhagia. *Only the intramural growth which is surrounded on all sides by an equal amount of uterine muscle grows slowly and remains within the confines of the uterine wall. It is this type of tumor which atrophies at the menopause. All other growths are evolved in the direction of least resistance.*

Repeated menstruation, pelvic inflammation, and pregnancy, all seem to have an influence on the rapidity with which the growth develops.

This is particularly evident in patients who miscarry, or in whom involution is arrested or tardy.

Fibroids are benign growths and do not always impair a woman's health. They may not produce symptoms, but when fibroids cause symptoms, they may be grouped into (1) those that are *suggestive* and (2) those that are *characteristic*.

The suggestive symptoms include:

- a. *Menstrual excesses and irregularities* evidenced by menorrhagia and metrorrhagia with their secondary cardiovascular effects, i.e., anemia, increase in pulse rate, palpitation, dyspnea, hemic murmurs, etc.
- b. *Abdominal enlargement due to the growing tumor mass.*
- c. *Dysmenorrhea* which usually appears in the form of *menstrual pain*.
- d. *Sterility and abortion.*

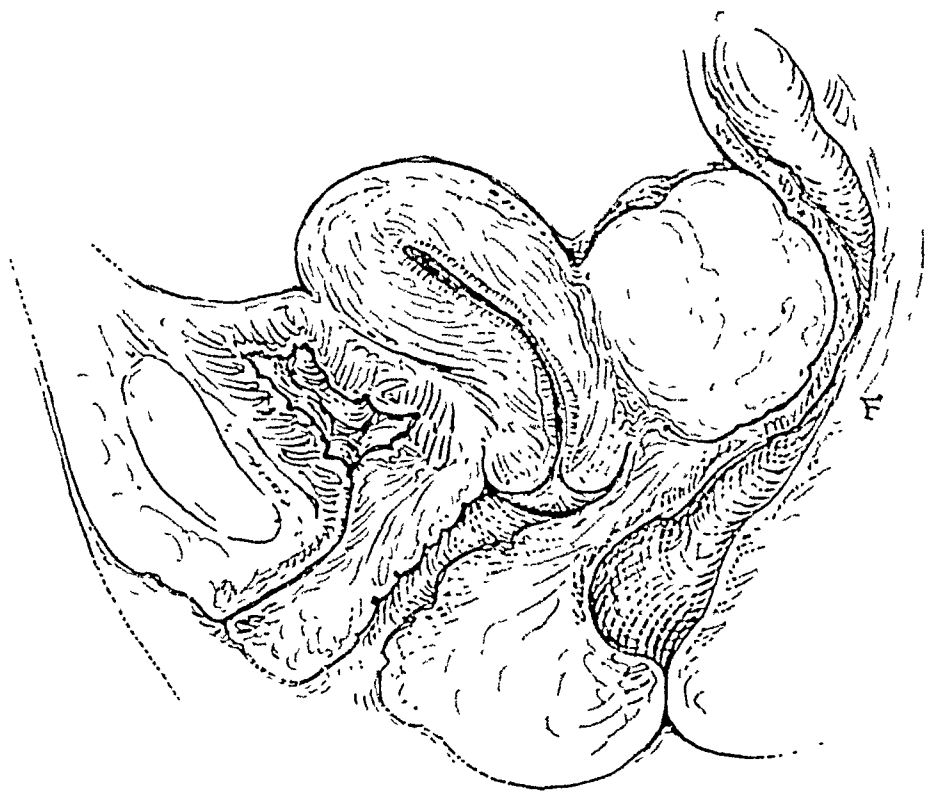


Fig. 5.—Subperitoneal growth with no bleeding, making pressure upon rectum, interfering with the hemorrhoidal veins, not amenable to radium treatment.

e. *Pressure effects*, as evidenced by urinary frequency, dysuria, difficult defecation, hemorrhoids, unilateral sciatic pain, edema, or varicosities.

f. *Leucorrhœa*—the increased blood supply necessary for the development of the growth produces a venous stasis in the unsupported cervix, which in turn results in a hypersecretion of mucus from the cervical glands.

g. *Digestive disturbances* which are due to three causes; the secondary anemia, the pressure on the rectum and colon and the presence of intestinal adhesions.

*Menstrual hemorrhage is common in interstitial and sessile submucous growths* which increase the area of endometrial response, while intermenstrual bleeding is always suggestive of pedunculated submucous tumors. The bleeding is not from the tumor but from the atrophic endo-

metrium stretched over it, or from the hypertrophic endometrium opposite, or from the congestion of the endometrium in the angle below it (Fig. 10). Any tumor which is extruded toward the uterine cavity and grows into it, increases the area of endometrial surface, blocks the venous return and must produce by pressure a venous hyperemia which will result in a diapedesis and rhexis. Metrorrhagia is always a result of tissue necrosis, areas of which occur in the overstretched atrophic endometrium.

*Comenstrual pain* is common in interstitial and submucous growths even before the tumor assumes great size. Many of our most intractable cases of dysmenorrhea are due to studding of the uterine muscle with tumors of less than 1 or 2 cm. in diameter. On the other hand, there

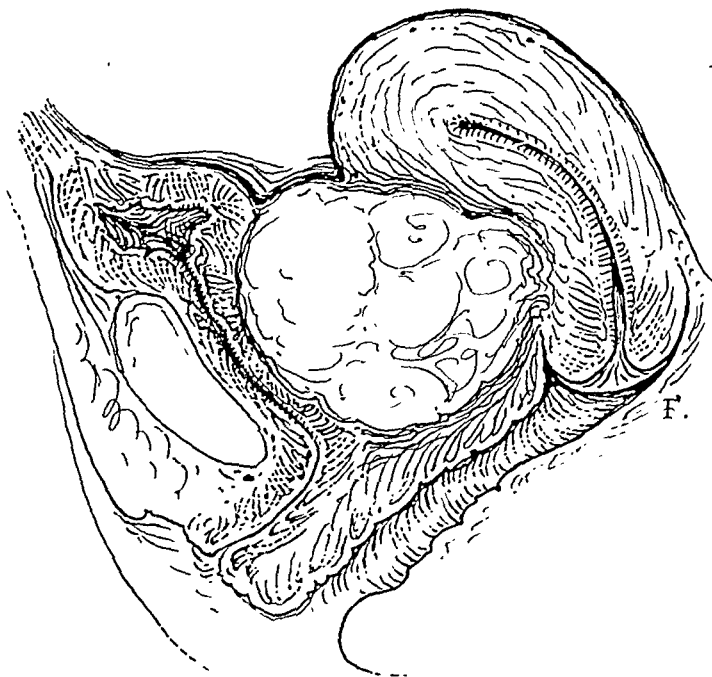


Fig. 6.—Subserous tumor—with no bleeding—producing dysuria. Not suitable for radium or x-ray treatment.

may be no pain at all in large subserous growths until their circulation is interfered with by torsion, displacement, or the formation of adhesions.

*Pressure effects* result from tumor growth with pressure upon the bladder, ureters, rectum, pelvic veins, and nerves, hence, pressure may produce symptoms referable to the urinary tract; as frequency, dysuria, hydroureter, and hydronephrosis, while pressure on the rectum or pelvic colon may result in intestinal flatulence, constipation, proctitis or hemorrhoids; likewise, tumors incarcerated in the culdesac or in the lateral fornices may produce varicosities of one or both extremities, or unilateral edema or sciatica. Interference with the bowel function by tumor pressure or by intestinal adhesions is perhaps the commonest cause of digestive disturbances.

*The characteristic signs of fibroid tumors are always apparent on physical examination. If the growth has risen out of the pelvis it presents as a smooth, hard, nodular, insensitive tumor mass, which is sharply defined, in the hypogastrium, or in one or the other lower*



Fig. 7.—Large cervical myoma—occluding the vaginal lumen—producing no symptoms until marriage. Requires operation.

quadrants of the abdomen. The upward or lateral excursion is limited unless the tumor is pedunculated. Bimanual examination reveals a mass connected with the uterus, asymmetrically enlarging it and inseparable from it; smooth, hard, nodular and sharply defined and usually insensitive, unless it is undergoing inflammatory or circulatory changes.

On passing a sound into the uterine cavity, the canal is almost always elongated and is frequently distorted.

Cervical, subvesical, and intraligamentous growths change the position of the cervix and are apt to displace the uterus upward or to one side (Figs. 6, 7). A uterine bruit is present in two-thirds of all myomas which attain a size sufficient to lift themselves out of the true pelvis, for lateral rotary torsion is relatively common. Pedunculated submucous tumors not only increase the size and change the symmetry of the



Fig. 8.—Large multiple myoma, not in relation to the uterine cavity. Urinary frequency the only symptom. Requires operation.

uterus, but stimulate uterine contraction which in time attempts to extrude the mass from the uterus and to dilate the cervix; hence, digital examination may reveal effacement of the lower uterine segment or protrusion of a smooth tumor mass into the cervical canal. As a confirmatory sign, the outline of the tumor and its relation to the uterus may be demonstrated by the fluoroscope after injecting oxygen into the peritoneal cavity, thus producing a pneumoperitoneum. However, routine fluoroscopy is not necessary in order to make the diagnosis.

All fibroid tumors are subject to pathologic change, these changes are *primarily circulatory* and result from the partial or complete cutting off of the afferent or obstruction to the efferent blood supply. It is apparent, therefore, that pregnancy must play an important rôle in the production of these changes, owing to the disparity between the size of myoma and their blood supply; atrophy, hyaline changes, and necrobiosis are of common occurrence. Edema is perhaps the most common circulatory change which occurs in a fibroid tumor. Edema of the tumor is present during menstruation and during pregnancy, for, under the influence of the latter all fibroids grow, and when the uterus is emptied and retraction and contraction take place, the efferent blood

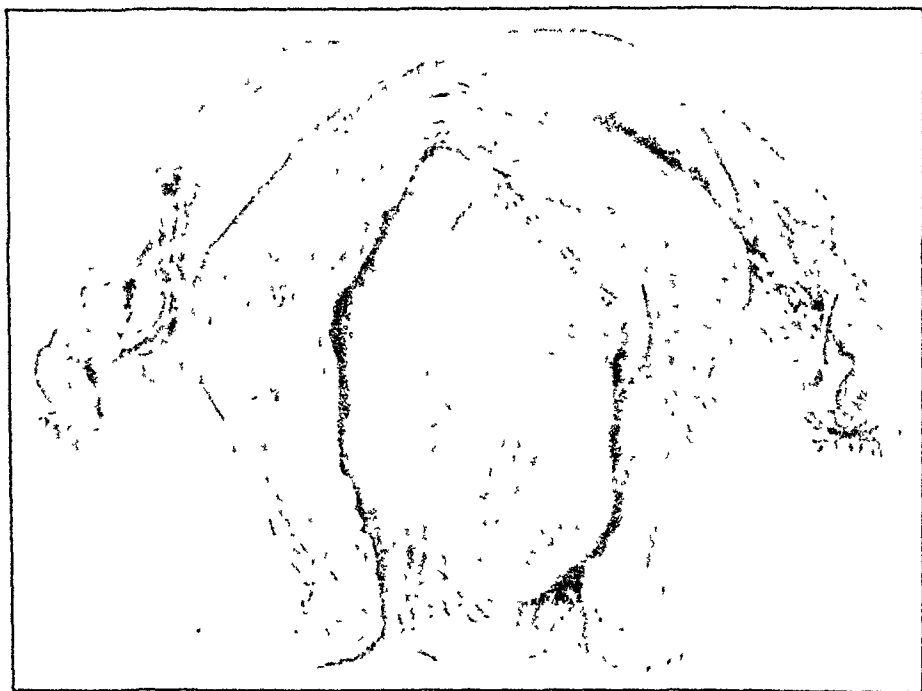


Fig. 9.—Pedunculated fibroid with terminal necrosis producing metrorrhagia. Radium or X-ray will increase the necrosis.

supply is obstructed and the tumor necessarily becomes edematous. Edema is an early stage of necrosis and it is the associated hyaline changes which are the origin of many of the fibrocystic areas found in these tumors. Hyaline degeneration is the first change to take place in a myoma, as a result of malnutrition. As it progresses liquefaction occurs and the tumor may become more and more cystic.

Necrobiosis may be described as partial death of the tissues in contradistinction to necrosis or total death, and it appears as red degeneration. Many of these tumors recover their lost vitality while others go on to necrosis. Myomas in a state of red degeneration are of comparatively soft consistency. The tumor enlarges rapidly, becomes sensitive and is associated with local pain, a slight elevation of temperature and a mod-

erate leucocytosis. Calcification and cystic degeneration are changes more usually found in subserous tumors.

Septic infection and necrosis from torsion may occur in both submucous and subserous growths. Every fibroid should be serially sectioned, for the incidence of sarcoma and carcinoma is sufficiently large to seriously effect the prognosis.

Fibroid tumors complicate pregnancy and labor. They may also cause

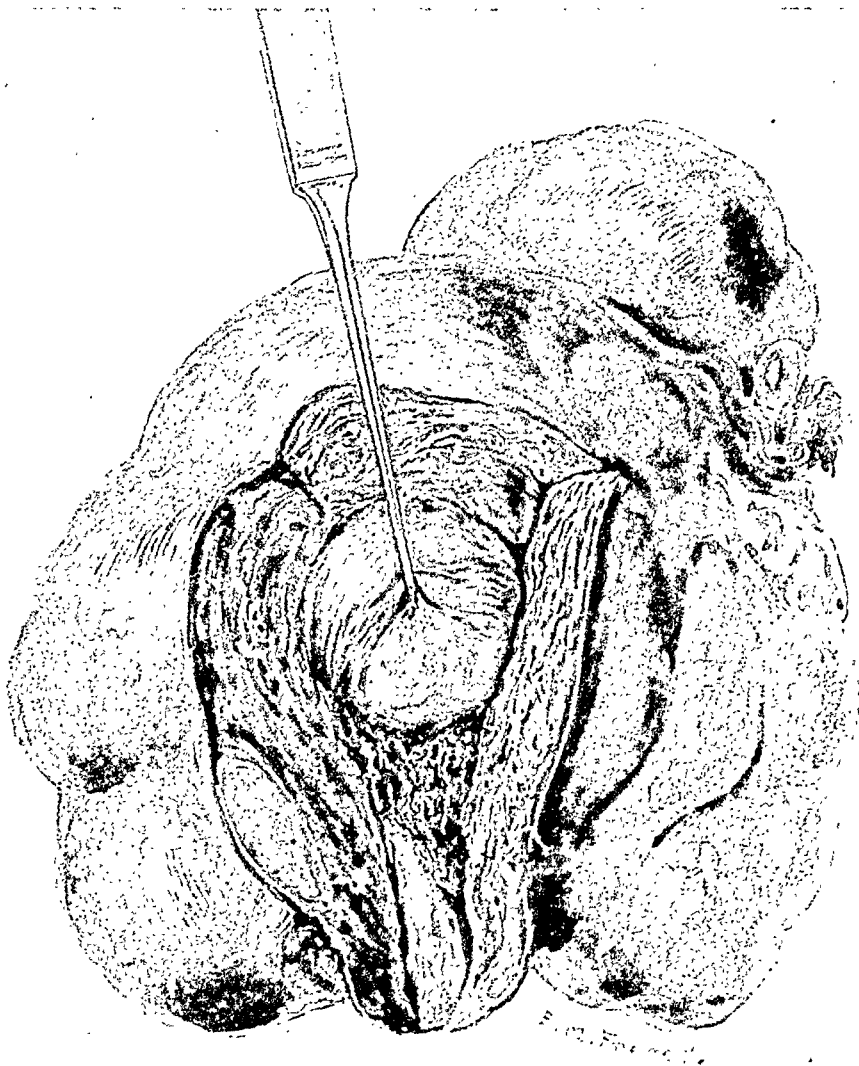


Fig. 10.—Multinodular tumor, showing all types of myoma, with atrophy and hypertrophy of the endometrium.

sterility, and if the patient does conceive, favor the occurrence of abortion; or they may grow to such a size during pregnancy as to embarrass the cardiac and respiratory functions of the woman.

Torsion and red degeneration are relatively common complications during pregnancy. While a pedunculated tumor may be removed without disturbance of the pregnancy, myomectomy on interstitial growths should never be considered. The majority of tumors do not interfere

with labor except by producing malposition of the fetus, because they are lifted out of the pelvis in the course of uterine contractions and during dilatation. Only cervical growths incarcerated in the pelvis obstruct labor. It is wise, therefore, to let the woman with a fibroid tumor have a test of labor under intelligent supervision, for many deliver spontaneously. When labor is obstructed, section and hysterectomy are the procedures of choice.

*Treatment.*—Many fibroids need no treatment, for they produce no symptoms and do not grow for long periods of time. But all women who are the subjects of fibroid tumors should be under observation, reporting for examination at definite intervals. Fibroids demand treatment for the (1) control of hemorrhage, (2) relief of pressure, and (3)



FIG. 11.—Submucous tumor having undergone cystic degeneration—producing exhausting hemorrhage not controlled by radium. Consistency of tumor suggestive of pregnancy without any other signs. Operated.

rapid or progressive growth, torsion, and degenerative changes. Bleeding may always be controlled by rest, packing, x-ray, and radium. Drugs have little effect. The curette, aside from its diagnostic value, has no place in the treatment of hemorrhage caused by a fibroid. Radium may be used for the control of hemorrhage in tumors, *within the confines of the uterus*, if the tumor is not larger than a three months' pregnancy, and is without adnexal growth or parametrial or peritoneal lesions.

Before subjecting any woman to x-ray or radium therapy, she should be examined under anesthesia to determine the exact relation and location of the tumor mass or masses, and a diagnostic curettage should be



made to exclude malignancy. All scrapings should be submitted to a pathologist.

The following types of tumor demand operation:

1. Tumors larger than a three months' pregnancy.
2. Rapidly growing tumors which suggest progressive changes.
3. Tumors producing pressure symptoms.
4. Tumors associated with pelvic pain.
5. Pedunculated tumors, in which radium only increases the necrosis.
6. Tumors with adnexal pathology.
7. Tumors with associated secondary anemia (cachectic appearance) in which the uterine hemorrhage has not been sufficient to account for the degree of anemia.
8. Tumors in young women.
9. Multiple submucous tumors distorting the uterine cavity (radium in these cases is likely to produce pyometra), and finally, in cases where the tumor mass cannot be definitely differentiated, and in women who fear radium.

All of these cases require either myomectomy or hysterectomy.

20 LIVINGSTON STREET.

## POSTMORTEM FINDINGS IN TEN CASES OF TOXEMIA OF PREGNANCY

By J. WARREN BELL, M.D., PH.D., EVERETT, WASH.

**I** PURPOSE in this paper to present data obtained from study of material at my disposal, emphasizing the widespread nature of the condition by a comparison of lesions in various organs, with special attention to the appearance of the liver lesions.

In 1886 Jurgens<sup>1</sup> first found the hemorrhagic liver lesions and claimed that he could demonstrate them constantly in eclampsia. He also found what he thought were liver cells in the lungs of some cases at postmortem examination.

In 1893 Schmorl<sup>2</sup> insisted that eclampsia had a definite complex of changes characteristic of no other disease. He reported seventy-three deaths with convulsions and three deaths late in pregnancy without convulsions, and at the autopsy he demonstrated lesions in the three cases without convulsions similar to those found in the convulsive cases. He noted lesions in the lungs also, though much more rarely than in the liver. He found placental cells in the lung in 150 cases, 83 of which had had eclampsia. Thus, we see that these cells can migrate, even in normal pregnancy. He carefully described the lesions in the kidney, liver, brain, and heart.

In 1902 Aseoli<sup>3</sup> endeavored by experimental methods to determine the cause of the eclampsia, and attributed it to the overproduction of lytic substances.

The same year Weichardt<sup>4</sup> and separately Scholtens<sup>5</sup> and Veit attempted a research in this field. Weichardt explained the mechanism as in certain bacterial diseases.

In 1907 Opie<sup>6</sup> studied the zonal necrosis of the liver and stated that the periphery of the lobule is more likely to have fatty metamorphosis because it is in contact with blood from the portal vein. He claimed that the central zone was the chief seat of amyloid degeneration, while the central part of the lobule was the most common seat of pigmentary infiltration. He suggested a relation between infection and zonal necrosis.

Konstantinowitch<sup>7</sup> in 1907 reported thirty cases with more attention given to the clinical history, and on the basis of the liver lesions he divided his cases as follows:

1. Peripheral zone shows moderately dilated capillaries while cells are rounded with a shrunken nucleus which stains poorly.
2. Fibrinous thrombi in the periphery with extending cellular degeneration.
3. Diffuse necrosis, not limited to the liver cells, sometimes involving connective tissue also. Areas are large.

Pottet<sup>8</sup> and Kervily examined the thyroid gland in four fatal cases of eclampsia. They found a condition similar to the condition seen in puerperal sepsis.

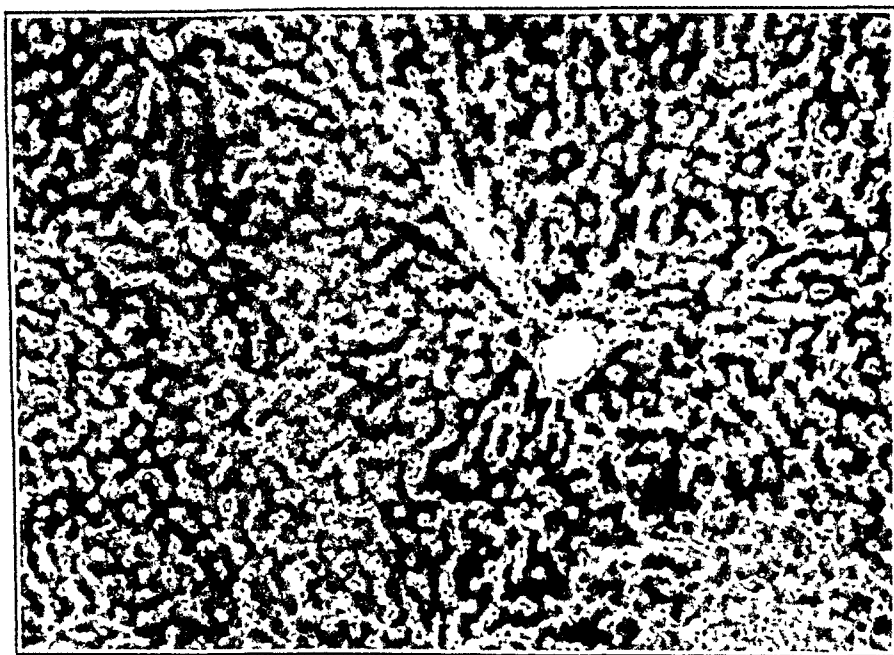


Fig. 1.—Passive congestion (low power). Narrowing of cords in central portion of lobules. No necrosis or other degeneration.

Also in 1907 Frank<sup>9</sup> injected placental extract into the same and other animals in an effort to learn more of the mechanism of eclampsia.

In 1908 Chirie<sup>10</sup> decided that suprarenal changes were not the cause of eclampsia.

Eardley Holland,<sup>11</sup> in 1909, gave a review of the literature and inserted a few of his own ideas.

The work of J. Edgar Welch<sup>12</sup> also about 1909 is the finest contribution on the subject which it has been my pleasure to see. His cases are carefully studied from the clinical standpoint and are thoroughly worked out from the pathologic side.

In 1912 Franklin Newell<sup>13</sup> gave the causes of death in eclampsia as follows:

1. Acute cardiac dilatation.
2. Edema of the lungs.
3. Cerebral hemorrhage.
4. Necrosis of the liver.
5. Shock.

Dr. J. Whitridge Williams<sup>14</sup> at about the same time emphasized the differences between the toxemias of early pregnancy leading to pernicious vomiting and those of late pregnancy like eclampsia.

Young,<sup>15</sup> in 1914, was the first man to study carefully the infarcts in the placenta, and he stated that the changed tissue gave rise to a toxin responsible for the clinical picture of eclampsia.



Fig. 2.—Section showing markings in left lobe. Necrotic area with cell outlines lost is separated from adjoining liver tissue by a definite wall of leucocytes. Outline of necrotic area and nearness of thrombosed vessel suggest an infarct.



Fig. 3.—Infarct and thrombosed vessel (very low power).

In 1919 Sir William Smyly,<sup>16</sup> of the Rotunda Hospital in Dublin, called attention to a relation between accidental hemorrhage and eclampsia.

Foster S. Kellogg<sup>17</sup> again stressed the relationship between infection and the toxemias of pregnancy. In this discussion he quoted data from the study of 400 cases of toxemia.

In 1920 Cleisz<sup>18</sup> called attention to the strain upon the aorta in labor.

John A. Killian<sup>19</sup> and Carl P. Sherwin worked upon the blood chemistry in toxemias of pregnancy and published their findings in 1921.

About the same time Dr. Wm. E. Caldwell,<sup>20</sup> working with A. G. Lyle, reported work of a similar nature. Both articles appeared at the same time and should be studied together, to get the best information upon this interesting phase of toxemia.

The following year, 1922, Dr. O. M. Grubitz<sup>21</sup> suggested that agglutination of

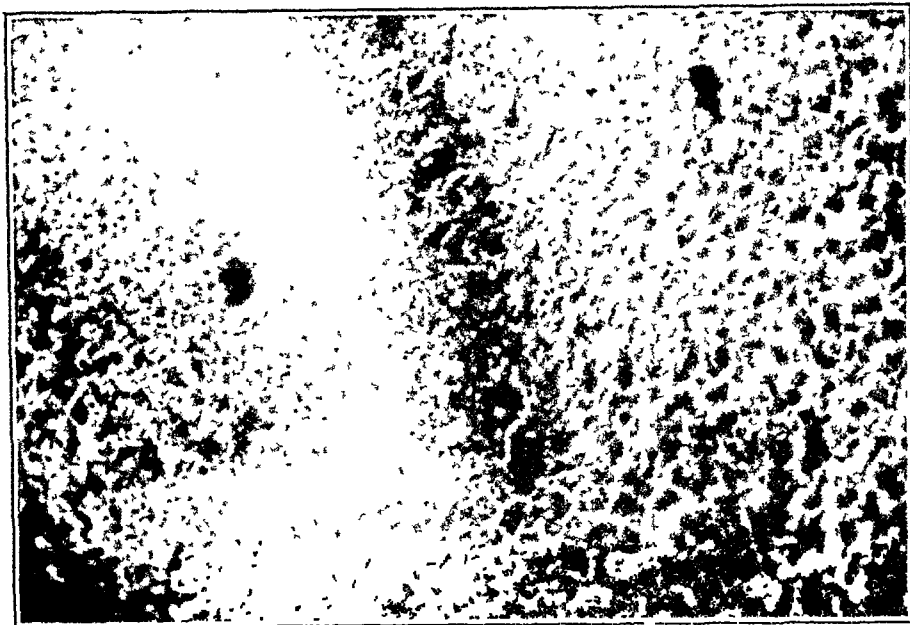


Fig. 4.—Wall of blood vessel (low power).

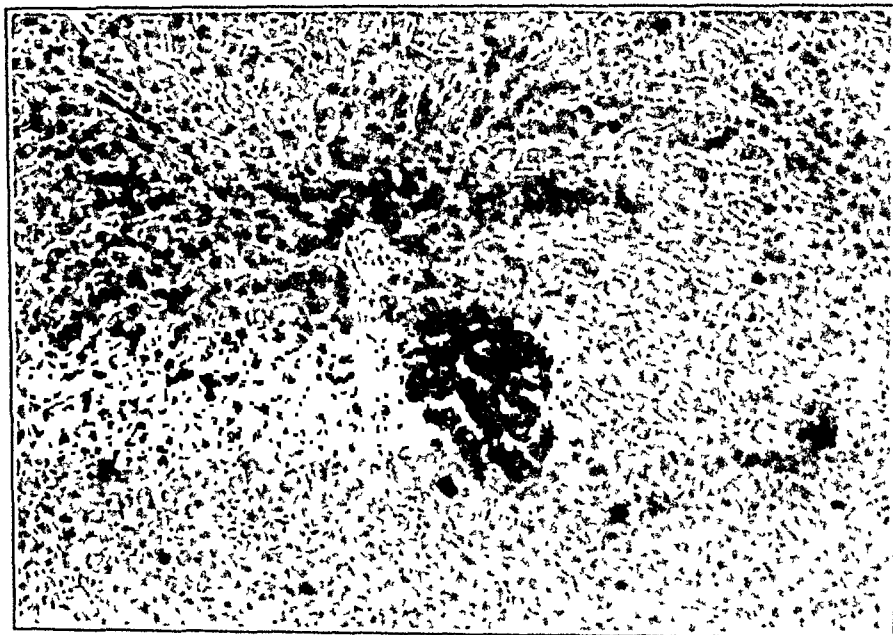


Fig. 5.—Localized deposit of fat (high power). Section with fat stain shows a dark island where fat is present; cords appear normal, nuclei are large; there is round-cell infiltration of the smaller portal spaces.

the fetal red cells by the mother's blood serum might be a factor in eclampsia, by giving small thrombi in the capillaries of the liver, kidneys, brain, etc.

McNalley and Dieckmann<sup>22</sup> also in 1922 brought forward evidence showing the part which hemorrhage in the placenta plays in infarct formation. A large series of cases is quoted and the illustrations are splendid.

This brief review of the literature will serve to show that many factors must be given attention and will, I hope, form a background for a better understanding of the condition.

Turning to the records of the pathologic department, where thousands of complete autopsies are on file, but ten cases of eclampsia could be

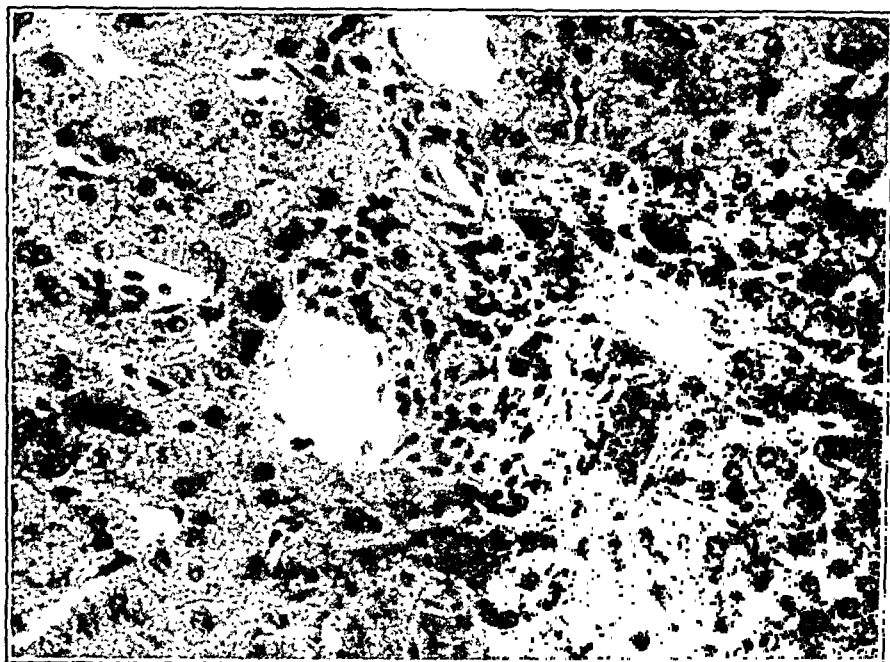


Fig. 6.—Round-cell infiltration of portal spaces (high power).



Fig. 7.—Section in acute yellow atrophy. Changes so marked as to make tissue difficult to identify; only the connective tissue framework is visible in some areas.

found. It was decided to take these ten cases and study them in detail. The separate organs were considered in groups for classification. The ten cases of toxemia form the basis for the data to follow:

1. All occurred during the last four months of pregnancy. Five of them had convulsions.
2. The majority of the patients had been ill from a few days to a few months.
3. Jaundice was noted at only one autopsy.

4. The diaphragm on the right side was found between the third rib and the fourth interspace, and on the left side from the fourth rib to the sixth interspace.
5. A subperitoneal hemorrhage covered a portion of the lower surface of the diaphragm in one instance.
6. Small amounts of fluid were present in the abdomen in three cases.
7. Half the cases had from 50 to 700 c.c. of fluid in one pleural cavity. In two cases the fluid was clear. In two cases it was bloody. In one case it was purulent.

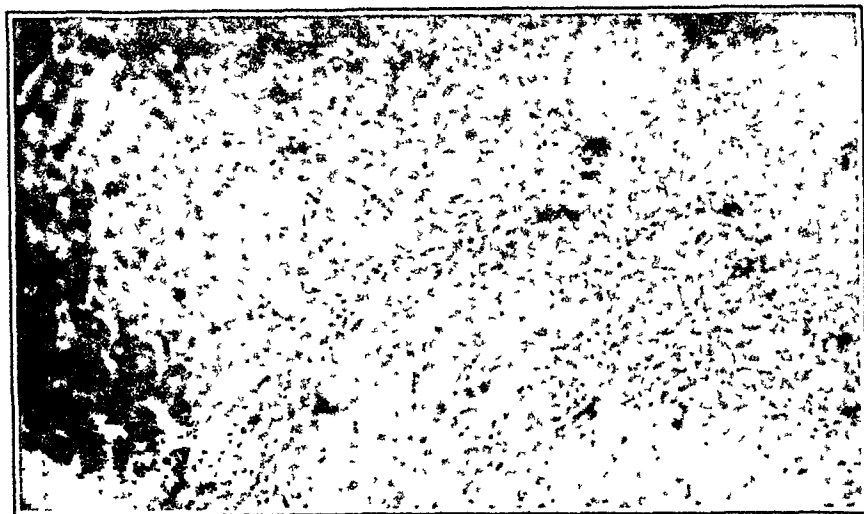


Fig. 8.—Diffuse fatty infiltration (low power).

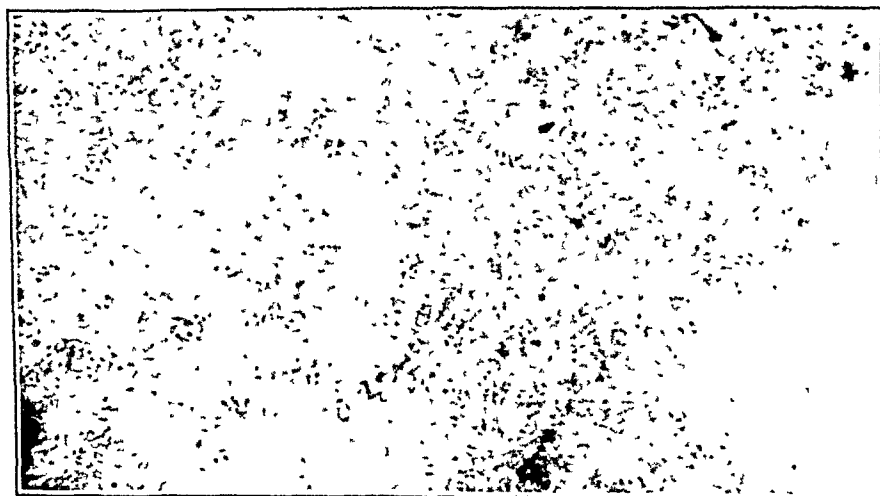


Fig. 9.—Diffuse fatty infiltration (high power).

8. In the half of the group having exudate present, lung lesions varying from passive congestion to solid nodules could be demonstrated.
9. Microscopically examined, these lungs revealed edema, chronic passive congestion, bronchitis, early bronchopneumonia, hemorrhage, and abscess.
10. The average weight of seven hearts was 325 grams. These varied from 260 grams to 500 grams. The largest heart was from a woman who weighed about 130 pounds.
11. The pericardium contained from 3 to 50 c.c. of fluid in every case. In two cases it was blood stained; in one case purulent.

12. The myocardium was variable in consistency from normal in most instances to soft and flabby in a few instances. Nothing of importance was noted in the coronaries.

13. The aorta was recorded as showing nothing more than a few patches of sclerosis.

14. The weight of the spleen in seven cases ranged from 90 to 290 grams, an

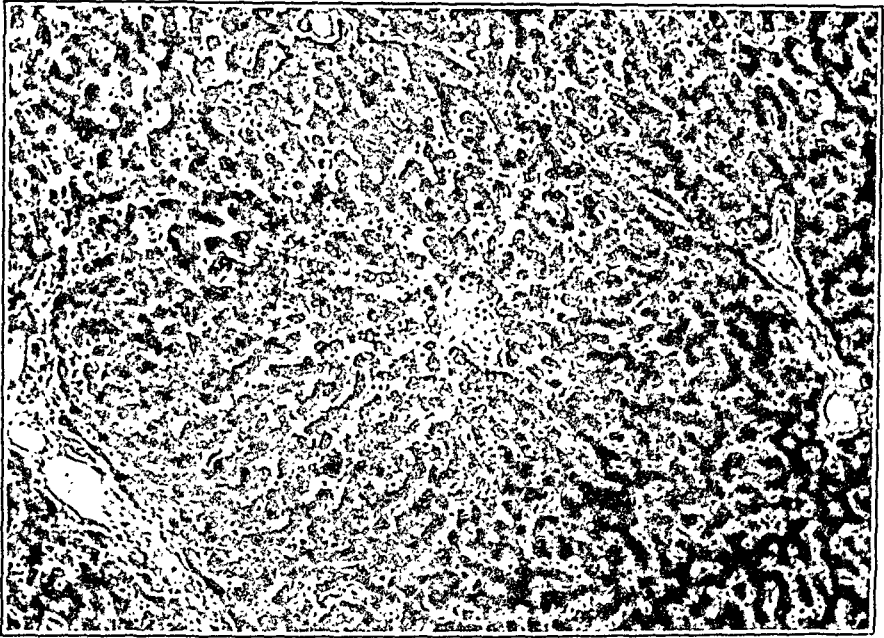


Fig. 10.—Passive congestion (low power). Slight passive congestion with some fat; cords narrow in centers of lobules.

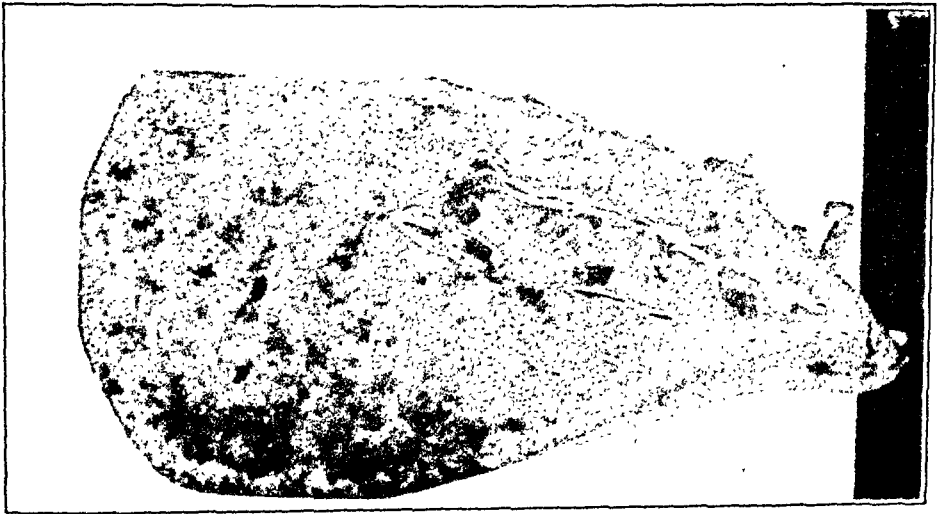


Fig. 11.—Section showing extensive confluent subcapsular hemorrhages and red hemorrhagic areas. Areas of hemorrhagic coagulation necrosis; diffuse patches of swelling and vacuolization of cells; some cords much swollen.

average being 170 grams. In six cases the capsule was smooth or tense. Corpuseles were visible in eight cases. The color varied from pinkish gray to dark brown.

15. The appendix was present in every case and in no instance showed active acute inflammation.

16. The digestive tract showed no gross lesions. In two instances the stomach was found full of bile stained fluid.

17. No lesion was noted in the pancreas.

18. There was no gross evidence of disease in the adrenals.

19. The kidneys of eight patients ranged in weight from 120 grams to 220 grams. The capsule usually stripped easily, leaving a smooth surface. The cortex was often swollen and pale.

20. The right ureter was dilated three times. In one of the three cases the left ureter also was dilated. The bladder was dilated in two cases.

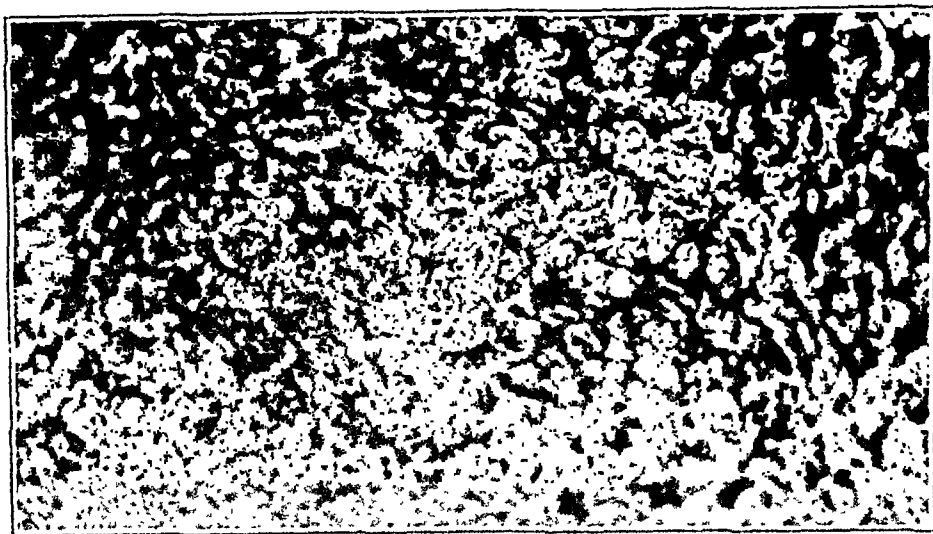


Fig. 12.—Focal hemorrhagic necrosis (low power).



Fig. 13.—Focal hemorrhagic necrosis (low power).

21. No lesion of the gall bladder was noted.

22. The condition of the liver is of considerable interest and will be taken up separately for each case. The weight varied from 1295 grams to 2120 grams, with an average for eight cases of 1751 grams.

AUTOPSY 178.—*Gross*: Cloudy swelling present; pumpiniform plexus intensely congested; few adhesions between both lobes of liver and the diaphragm. Left lobe soft, friable, and elongated. Lobular markings distinct. *Microscopic*: Culture from liver showed small white colonies of bacteria like *B. pneumoniae*.



**AUTOPSY 10-73.**—*Gross:* Liver weighed 1500 grams; paler than normal; a distinct band of fibrous adhesion between the liver and the diaphragm; in other areas a decided thickening of the capsule. On section there was a slight amount of congestion and from the cut surface quantities of fat could be scraped.

**AUTOPSY 15-146.**—*Gross:* Gall bladder and ducts normal; capsule smooth and clear, with a yellow appearance. Cut surface showed a blanched appearance due to postmortem embalming. *Microscopic:* (See Fig. 1.)

**AUTOPSY 15-155.**—*Gross:* Weight was 1820 grams. Gall bladder and ducts normal. Capsule smooth. Surface of left lobe was mottled with red and yellow spots. On section there were numerous yellowish patches of softening beneath the capsule. These extended under the major portion of the surface of the left lobe (Fig. 2). The central portion of the lobe was not involved. The right lobe showed no such areas. The cut surface of the right lobe had a pale yellow color, but the central portions of the lobules were dark red. *Microscopic:* (see Figs. 3 and 4).

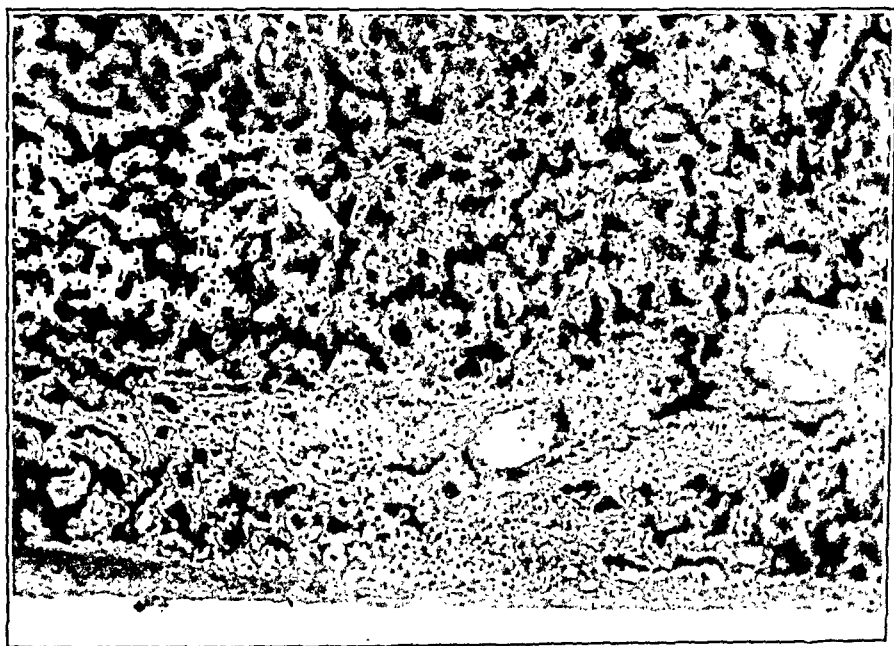


Fig. 14.—Coagulation necrosis beneath the capsule (low power).

**AUTOPSY 16-197.**—*Gross:* Weight 1908 grams. Margin well rounded. Capsule light chrome yellow and smooth. Cut surface mottled by a rather large yellowish white area with a pinkish yellow tinge. Lobular markings in themselves obliterated. Cut surface had a greasy feel and was friable. Gall bladder distended with thick, dark bile which contained mucus. *Microscopic:* (see Figs. 5 and 6).

**AUTOPSY 18-171.**—*Gross:* Weight 1500 grams. Lower margin corresponded almost exactly to the infracostal margin. The cut surface of the liver had a grayish yellow cast. The central veins stood out prominently and were surrounded by grayish yellow zones. The gall bladder showed no lesions. *Microscopic:* (see Figs. 7, 8 and 9).

**AUTOPSY 19-190.**—*Gross:* Weight 1950 grams. Capsule smooth and studded with hemorrhagic areas. These areas were larger and more closely set in the posterior surface than in the anterior surface. The cut surface everywhere showed irregularly distributed hemorrhagic areas varying in size from a few millimeters to 1 cm. The hemorrhages tended to be distributed in groups. The intervening liver tissue

was cloudy and slightly yellowish in appearance. No gross change in gall bladder or bile ducts. *Microscopic*: hemorrhagic areas show necrosis of the liver; cords are seen with escape of erythrocytes outside the capillaries; elsewhere there is diffuse fatty metamorphosis of the liver.

**AUTOPSY 20 358.**—*Gross*: Capsule smooth; surface showed no special markings; no lesions of the gall bladder. *Microscopic*: (see Fig. 10).

**AUTOPSY 21 177.**—*Gross*: Weight 1914 grams; external subcapsular hemorrhages over the superior, anterior, and lateral surfaces of the right lobe; a few such hemorrhages scattered elsewhere on the surfaces. The cut surface everywhere was studded with dark hemorrhagic areas. The intervening tissue had a brownish yellow color. No disease of gall bladder or bile ducts. *Microscopic*: (see Figs. 11, 12 and 13).

**AUTOPSY 22-306.**—*Gross*: Weight 2120 grams; surface smooth; color light brown. On section the color seemed normal. The consistency was not changed. The centers

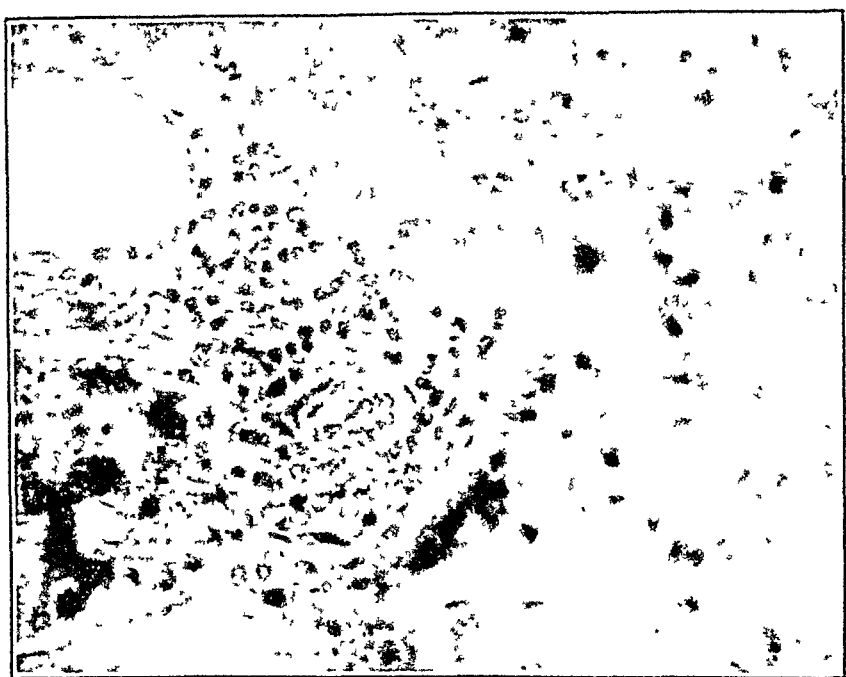


Fig. 15.—Cellular infiltration (high power).

of the lobules were not darkened. *Microscopic*: some cords stained faintly; small area of coagulation necrosis beneath capsule; some round cell infiltration around the portal canal. (Figs. 11 and 15.)

#### SUMMARY

In these cases there is little agreement in the liver lesions, which include passive congestion, localized fatty infiltration, acute yellow atrophy, infarction, hemorrhagic necrosis, cellular infiltration (chiefly of portal spaces). These data weaken our belief in any one lesion of the liver being considered essential for toxemia of pregnancy.

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MEDICAL AND DENTAL BUILDING.

## URETERAL OBSTRUCTION IN WOMEN\*

BY GEORGE M. LAWS, M.D., PHILADELPHIA, PA.

MORE than 30 per cent of patients who come to a gynecologic service complain of urinary symptoms and it is evident that problems connected with the pelvic ureter must be dealt with by the pelvic surgeon. To be accurate in diagnosis he must recognize the pathologic conditions that are associated with lesions such as ureteritis, stricture, tuberculosis, kinks and distortions by the pregnant uterus, tumors and adhesions. This report is based chiefly upon a study of the last fifty patients personally examined by ureteral catheterization in the gynecologic service of the Presbyterian Hospital, in whom more or less ureteral obstruction was found.

The principal clinical diagnoses may be placed in the following groups.

Nephroptosis and hydronephrosis (noninfected)-----	5
Pyelitis, chronic or recurrent-----	4
Pyonephrosis -----	4
Pyonephrosis and renal calculi-----	3
Pyelitis of pregnancy and puerperium-----	5
Ureteral anomaly -----	2
Ureteral stricture, traumatic-----	1
Ureteral stenosis -----	8
Ureteral calculus -----	18
Total -----	50

The obstructive lesion was actually a stricture in six cases, one tuberculous, two traumatic, following ureteral injury during complete

\*Read at a meeting of the Obstetrical Society of Philadelphia, February 4, 1926.

hysterectomy and three inflammatory, verified by operation. It is believed that some of the cases in which the term stenosis is used were also strictures but they were not absolutely proved.

About two years ago the location of the point of obstruction in approximately half of the cases was charted. Fig. 1 shows the cases of impacted ureteral calculus and Fig. 2 the clinical diagnosis and the obstructive site in the nonecalculus cases.

A review of this material showed that calculi may be arrested at various points not corresponding accurately to the so-called normal points of anatomic narrowing. It is well known that the size of a calculus bears but little relation to its symptoms and that fairly large

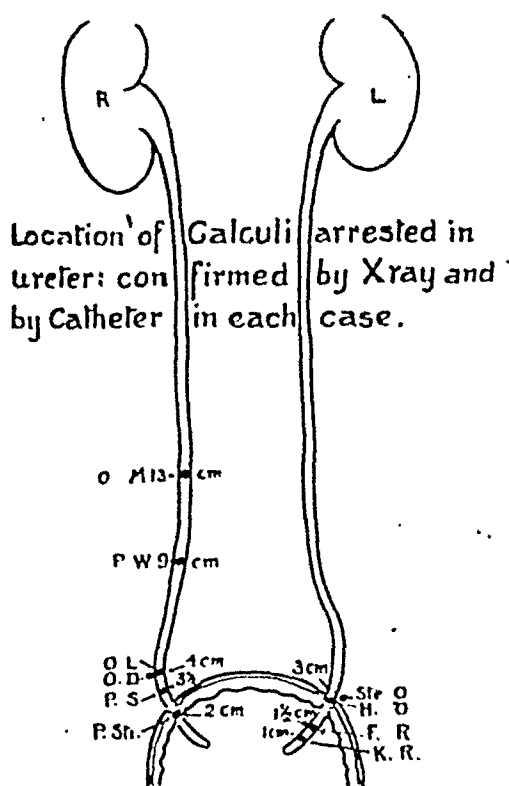


Fig. 1.—A series of impacted ureteral calculi showing the distance above the ureteral orifice at which each was arrested.

calculi may be passed by some patients and small ones may become impacted in others. The caliber of the ureter is variable in different individuals and one can hardly define the normal caliber at different levels. The narrowest points seem to be at the broad ligament, about 3.5 cm. above the ureteral orifice, and at the ureterovesical junction.

The symptoms of ureteral obstruction of various types are practically the same as those of an impacted ureteral calculus and vary with the location and degree of obstruction and with the presence or absence of infection and with its severity.

The chart of nonecalculus obstructions represents patients that were examined by ordinary No. 5 or No. 6 catheters as a rule, since larger

sizes were rarely employed during the period in which they were examined. It occasionally happens that difficulty arises in passing a catheter beyond a certain point, but this can almost invariably be overcome by the use of another catheter or by an attempt at another sitting unless some pathologic process exists. The x-ray was used routinely and pyelograms and ureterograms were made occasionally. Functional tests, usually with indigo-carmin, were made routinely and were almost constantly indicative of reduced renal function when ureteral patency was found to be affected. The diagnosis indicated on the chart was proved by operation in a good many instances. The

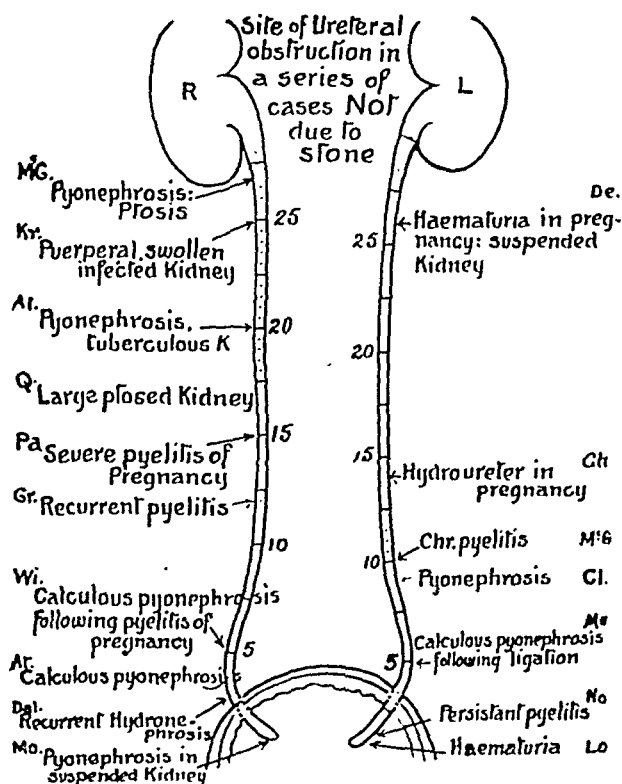


Fig. 2.—The chief clinical diagnosis in a series of noncalculous obstructions of the ureter and the location of the obstruction.

operations were performed by various members of the hospital staff and by the author.\*

Obstruction in the ureter causes dilatation above it and dilatation of the pelvis as well as the changes in the parenchyma which have been shown. Hydronephrosis may occur without dilatation of the ureter and vice versa.

This study strengthened the conviction that obstruction, infection and stone formation are stages in the same pathologic process. Fur-

\*The pathologic changes in the kidney parenchyma, of some of the patients referred to in the chart are shown in Figs. 3-9. The descriptions were written by Dr. John Elman, Pathologist at the Presbyterian Hospital, who studied them and who has pointed out the effects of ureteral obstruction which are not necessarily associated with dilatation of the pelvis. The credit for this work is his and the writer is indebted to him for the illustrations.

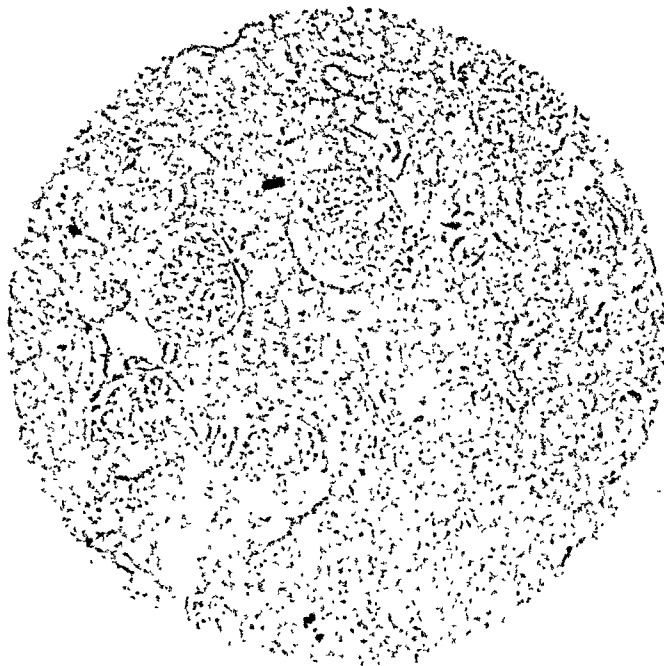


Fig. 3.—Movable kidney. Biopsy section secured at operation for Dietl's crisis. Dilatation of tubules due to back pressure which distends them. Cells in good condition but somewhat flattened out. Space of Bowman enlarged and glomeruli show degenerative changes.



Fig. 4.—Biopsy section secured at exploratory operation for hemorrhage in pregnancy from a previously suspended left movable kidney. Changes due to back pressure. Cells show degenerative changes. Space of Bowman increased with atrophy of tufts.

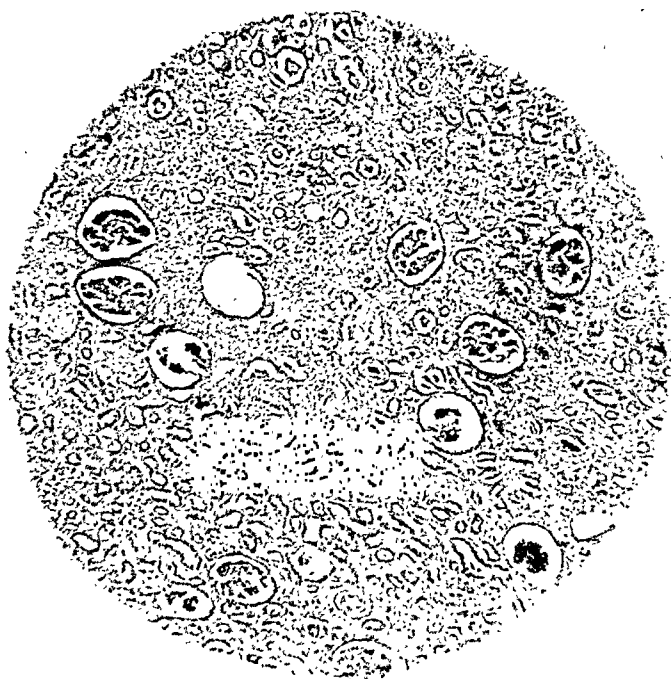


Fig. 5.—Nephrectomy for suppurative pyelonephritis and impassable ureteral stricture. Some chronic interstitial change with overgrowth of connective tissue. Pressure atrophy of tufts of glomeruli.



Fig. 6.—Nephrectomy for acute suppurative pyonephrosis and tuberculous kidney. Marked interstitial changes. Some hyalinized glomeruli; pressure effects on cells of glomeruli. Collection of round-celled infiltrations.

thermore it showed that the obstructions that had been recognized were associated with advanced pathologic conditions. This led to the belief that earlier stages and lesser degrees of obstruction should be

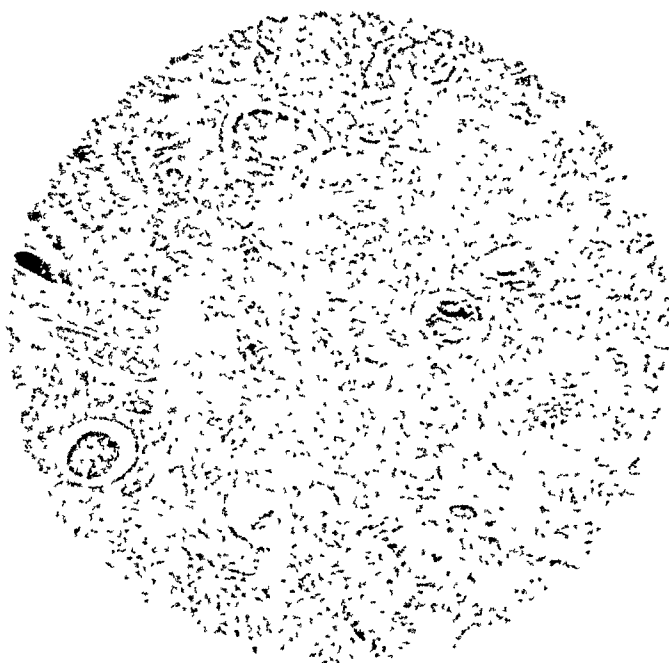


Fig. 7.—Nephrectomy for calculous pyonephrosis. Diffuse infiltrations with small round cells and polys. Effects of back pressure as seen in glomeruli.



Fig. 8.—Nephrectomy for acute pyonephrosis and old nephroptosis. Ureteral kink. Chronic interstitial nephritis. Distended capsules of Bowman from back pressure. Atrophy of tufts.

diagnosed. To this end bulb catheters were employed, with the teachings of Hunner as a background, for investigation of what may be called strictures of large caliber and other form of ureteral stenosis



of lesser degree. Ureteral stricture can hardly be mentioned without raising many points that have been the subject of controversy between Hunner and his school, on one side, and certain eminent urologists on the other. These subjects are of the greatest academic interest and no doubt we shall eventually learn the truth. In the meantime one may try to form an independent opinion based upon his own work. Briefly the technic is the use of an indirect vision operating cystoscope which will permit the use of bulbs and dilating catheters up to 12 mm. in circumference. The bulb catheter is passed and the behavior noted, particularly as it is withdrawn. In seven patients, in whom no pathologic process could be found, the No. 10 bulb was

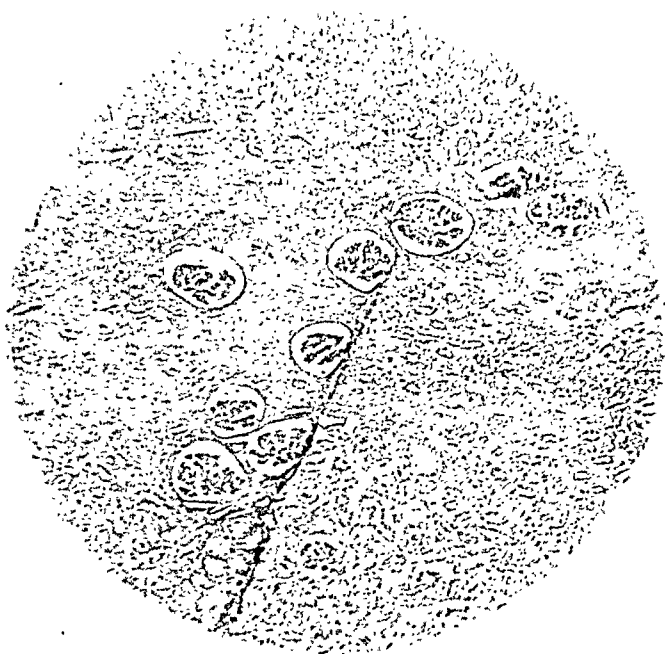


Fig. 9.—Nephrectomy for calculous pyonephrosis of long standing following pyelitis of pregnancy. Some interstitial changes but very distinct back pressure effects on glomeruli.

readily passed and withdrawn without the "hang," except in one instance when it could be seen to drag upon the bladder wall. These patients had had either repeated attacks of pyelitis or severe pain referred to the kidney region. They were regarded as negative.

In one patient who had chronic pyelitis with frequent renal colic and dilatation of whose ureter was shown by x-ray (Fig. 10) the No. 10 bulb was readily passed and no "hang" detected.

Marked improvement followed a single dilatation to No. 11 and lavage with mercurochrome. Further experience is required to determine whether or not this represents a "stricture" of a caliber larger than a No. 10, and raises the question whether one should be

content to dismiss the patients as having no stenosis, when the No. 10 bulb is withdrawn without a "hang."

Another patient had paroxysms of pain along the course of the pelvic ureter of about ten years duration, dating from an attack of cystitis. A distinct "hang" was felt, on withdrawing the No. 10 bulb, at a point 2 cm. above the ureteral orifice and the bladder wall was dragged upon and distinct bleeding immediately followed. The examination resulted in reproducing one of her typical attacks.



Fig. 10.—Pycelogram of patient with chronic pyelitis and recurrent renal colic following pyelitis of pregnancy.

The question before us at this time is: does this of itself mean "stricture," or does it mean "stricture" only if pycelogram or ureterogram show dilatation? Certainly one finds ureteral orifices too small to admit even a No. 10 bulb that have no associated symptoms and are presumably congenitally smaller than the average.

In another patient, who had chronic pyelitis, a No. 11 bulb would not pass through the ureteral orifice without trauma. On the other hand experience in dilating the ureter to help the passage of calculi

has shown that one can nearly always pass a bulb 12 mm. in circumference up to the calculus without too much force.

In four cases, in which the entire clinical study and repeated examinations were fairly conclusive of ureteral stricture, the No. 8 bulb corroborated this opinion by demonstrating a "hang" at the point of partial obstruction several centimeters above the bladder wall.

Two operative cases were found to have dense cicatricial strictures that had proved impassible even to No. 5 catheters as was a stricture previously reported which followed ligation of the ureter.



Fig. 11.—Same patient. Catheter partly withdrawn and ureter injected to show dilatation of ureter.

In another case of stricture following traumatic ureteral fistula and treated by gradual dilatation the No. 8 bulb revealed a "hang."

Before the time of using the bulbs for diagnosis the No. 9 Garceau dilating catheter was often noted as being gripped by the lower ureter at various levels on the catheter in such a way as to be fairly conclusive of decided stenosis.

The treatment of ureteral stricture one would expect to be analogous to treatment of stricture of other mucous canals and if possible by the plan of gradual, gentle dilatation. This has been effected in a few cases gaining one or two millimeters circumference at each treat-

ment. The dilatation should be at intervals not more frequent than ten to twelve days. Under this plan the gain is held and, when carried to what is believed to be full size, the gain is held for at least a number of months. Experience has not been long enough to determine whether or not it is permanent, but there has been no tendency shown to narrowing beyond the caliber of the last dilatation.

In one case of nephrectomy and one case of ureteral calculus, strictures that had been impassable from below were forcibly dilated by the operator from above. Both strictures promptly recurred.

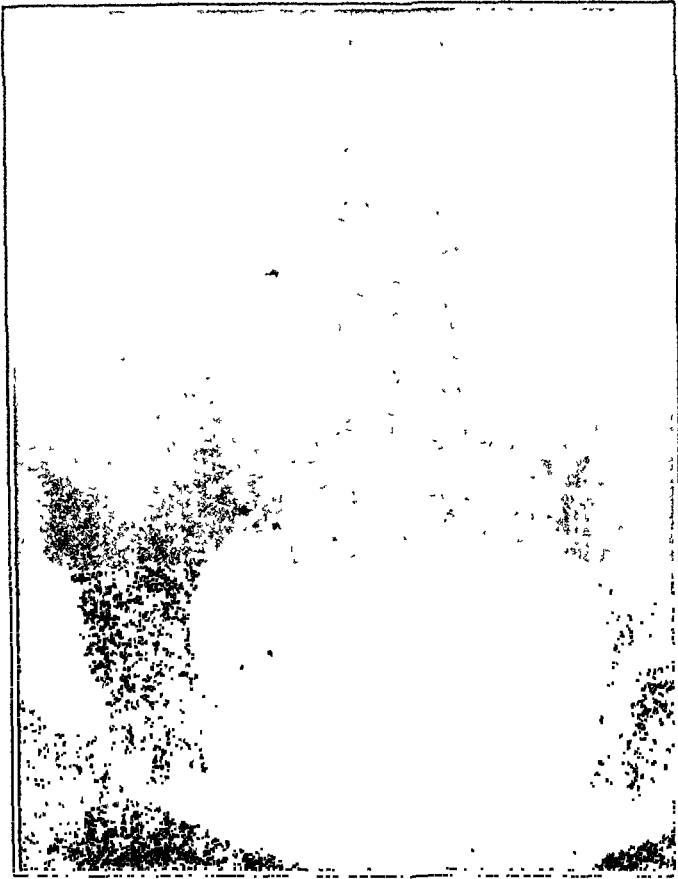


Fig. 12.—Ureteral stricture of small caliber with moderate dilatation of ureter but without dilatation of pelvis.

One patient (Fig. 12) required twelve treatments to carry the dilatation from No. 6 to No. 14 and local pain was not relieved until this point was reached. The ureterogram taken at the second examination shows a moderate dilatation of the ureter.

After dilatation to No. 12 failed to give relief the patient was examined by Dr. Hunner in consultation and the diagnosis confirmed. The repeated demonstration of narrowing at two points and the "hang" found on several occasions during the process of gradual dilatation had been convincing that this was a stricture without infection.

## CONCLUSIONS

1. There are various types of ureteral obstruction in women that are more frequent than ureteral calculus.
2. They are found associated with dilatation of the ureter, hydro-nephrosis or "back pressure" effects on the renal parenchyma. When these symptoms exist and calculus is not demonstrable, examination is usually indicated to determine the normal patency of the ureter.
3. Their symptoms are essentially similar to those produced by stone.
4. The bulbed catheter is the best instrument for this purpose, and for routine use it should be at least 10 mm. in circumference.
5. Gentle, gradual dilatation is the treatment of choice for ureteral stenosis.

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*(For discussion see page 892.)*

## INTRAUTERINE DEATH OF THE FETUS DUE TO ABNORMALITIES OF THE UMBILICAL CORD

### REPORT OF THREE CASES\*

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*(From the Department of Obstetrics, College of Medicine, Tulane University of  
Louisiana)*

THE majority of the textbooks on obstetrics which I have consulted, in discussing antenatal death in the latter part of pregnancy, consider particularly the questions of diagnosis and treatment. The possible causes of fetal death before the onset of labor are not mentioned in some works and are given but scant consideration in others, while a few texts cover the topic in a fairly satisfactory manner. The part played by cord anomalies is generally passed over. Williams, however, devotes three pages to the anomalies of the cord, but this discussion is not confined to those lesions capable of bringing about the death of the fetus. In most instances the intrauterine death of the fetus is due to syphilis, nephritis, or some other infection or toxemia from which the mother is suffering. Occasionally, painstaking investigation, including autopsy of the child, may fail to disclose the causative factor. Rarely, the seat of the trouble is found in the cord, and it is to this topic that I wish to direct attention.

This subject is considered in detail by Browne, of Edinburgh, in a recent paper. He has studied the matter carefully, as is shown by his bibliography of seventy titles. I am taking the liberty of quoting rather extensively from his article and wish to put on record three

\*Read before the New Orleans Gynecological and Obstetrical Society, March 11, 1925.

cases of fetal death due to cord lesions which have come under my personal observation. I am not considering the cases of intertwining of the cords of single ovum twins, which condition may at times lead to the death of one or both babies. I have observed this complication several times, but feel that this subject is best reserved for separate discussion.

True knots of the cord, according to Williams, occur very frequently, while Browne says that "the occurrence of true knots on the umbilical cord must be looked upon as somewhat rare." He quotes von Winekel as stating that they occur in 0.4 to 0.5 per cent of all births, and also states that Chantreuil reported 7 knots in 6075 deliveries, while von Hecker recorded true knots 115 times in 31,590 births. Some authorities state that these knots are of developmental origin but the general consensus of opinion is that they are produced by the passage of the fetus through a loop of the cord. Undue length of the funis and abundant liquor amnii are no doubt contributing factors. As a rule, the knot is slack and the fetal circulation is not impaired. I have observed this condition several times. Some writers claim that these knots can never tighten to such a point as to cause fetal death. Browne, however, has proved experimentally that this is possible. A cord was cut away from the placenta one hour after birth. A cannula was placed in the umbilical vein and was also connected to a mercury manometer. It was found that fluid passed through the vein at a pressure of 10 mm. A slack knot prevented the passage of fluid until a pressure of 20 mm. was reached, while two knots raised this pressure to 60 mm. Weights tied to the distal end of the singly knotted cord raised the pressure at which the fluid passed to a still higher level, and it was found that a weight of 160 gm. prevented the passage of fluid at a pressure of 165 to 170 mm. As the arterial pressure in the cord varies between 39.3 and 83.7 mm. of mercury, according to Feldman, while the venous pressure is usually 16 mm., it can be seen that the circulation through these vessels may be completely shut off by a traction of moderate degree exerted upon the knot. Browne tabulates twenty-six collected cases of fetal death due to these true knots.

Torsion of the cord is another condition which in rare instances has been held responsible for the death of the fetus. Dohrn in 1861 (quoted by Browne) collected eighty-five such cases from the literature. A certain amount of torsion, of-course, is found in practically every cord, one with no twists whatever being a rarity. The arteries are twisted around the deeper lying vein, usually from right to left; this is supposed to afford a measure of protection for the vein. It would appear that this physiologic torsion might easily become pathologic and it is surprising that fetal death is not produced in this manner more often than appears to be the case. Probably the mobility of

the fetus in the liquor amnii may contribute to the rapid untwisting of the cord before there is any interference with the circulation. It may be that, in case of fetal death due to torsion, there is some anomaly of the cord or some mechanical interference with the untwisting process. Browne is of the opinion that we are dealing with a thin cord, with little or no Wharton's jelly, and that this thin cord offers very slight resistance to the exaggeration of the normal torsion. There is thus a lack of elasticity, so that the "untwisting" is not so readily brought about. For example, the normal cord may be compared to a fairly thick rubber band, the other to a thin cotton string. Obviously, these, when submitted to torsion, would untwist at very different rates, and the rubber band would tend to a more complete recovery from the torsion than would the cotton string.

One of my cases falls in this group, and I will report it briefly. The patient had advanced a little past the eighth month of her second pregnancy, the first having terminated in an early miscarriage. Gestation had progressed normally. The pa-

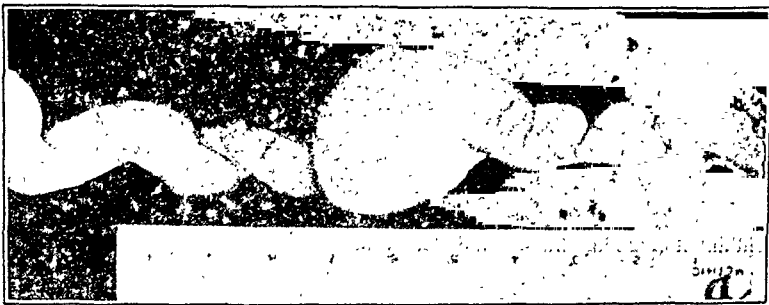


Fig. 1.—Note constriction at umbilical end of cord (a). Also marked torsion of remainder of section photographed.

tient noted rather excessive fetal movements, after which no further evidences of fetal activity were observed. Careful auscultation, repeated several times, failed to elicit fetal heart tones or uterine souffle, nor could any active movements be detected. One week after the cessation of fetal movements labor came on and a macerated infant was delivered. The cord was not measured, but was of normal length, and was very tightly twisted from the child's umbilicus all the way to the placenta. Close to the umbilicus the constrictions were especially marked (Fig. 1). Some of these twists were unwound, deep grooves were noted, and the cord resumed its condition of torsion when released. Only two vessels, an artery and the vein, were present (Fig. 2). Microscopic study of a segment of the cord, as well as of fetal liver, was negative. No *Treponema pallida* were found, and no lesions suggestive of syphilis were noted. The placenta showed no lesions other than a thrombosis of the vessels, and no *treponema* were found. The father's Wassermann was negative, as it had been on several previous occasions. The mother's blood was not tested, as the patient was delivered at home, and the husband, a physician, felt that the taking of blood for the test would occasion further mental disquietude. Both parents were perfectly healthy, and the cord condition was the only abnormality detected. I might remark that late torsion, such as occurred in this instance, seems to be the rarest form, being noted by Dohrn only once in the eighth month out of sixty-four cases. It is probable, in this case, that the presence of only one artery was a factor in the fatal

outcome, and it may be conceded that the torsion of itself might have resulted in death. But I am of the opinion that the torsion was the chief cause of the death of the baby. This patient has since been delivered of a living, healthy baby at term.

Occasionally, a localized constriction of the cord is found, most frequently at the fetal end, and involving an inch or so of the cord. I have observed two such instances. Extreme torsion may also be present, but was not noted in my cases.

In the first instance in which I noted this anomaly, the patient noticed cessation of fetal movements at the sixth month of gestation. She had previously given birth to a normal, healthy child, which is still living, and another healthy child has been born since this stillbirth. Careful and repeated examinations failed to elicit fetal heart tones or uterine souffle, and the uterus did not increase in size. Polak states that acetoneuria is always present when the fetus is dead, but it was not found in this case. One month after the death of the baby, spontaneous

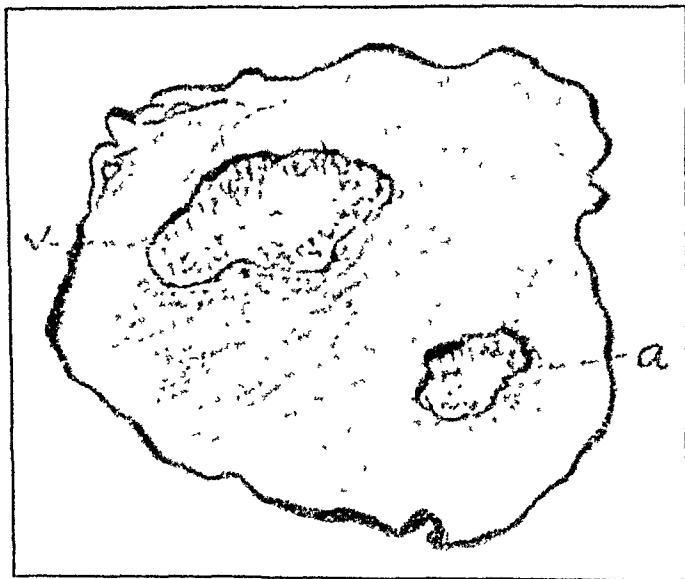


Fig. 2.—Drawing of a section through a part of the cord where it was of moderate diameter, showing only one artery (a) and one vein (v).

labor began, and a macerated fetus was delivered. The cord, of course, was flabby and discolored, but was otherwise normal except for a segment about one inch long, next the umbilicus, where it was very much constricted. This portion presented a shrivelled appearance, and there was no Wharton's jelly present (Fig. 3). There was no evidence of fetal, placental, or maternal lues. My second case of this character presented the same abnormality. This patient was also about six months pregnant, and the baby had been dead for many days. The cord was not sectioned in either case, as one specimen was saved intact, while the other was buried through error. However, I feel sure that the chief lesion was an obliterative inflammation of the vessels of the cord, as has been described in similar cases by Browne and others.

Many other lesions of the cord have been recorded by various observers. Browne has collected three cases of death due to ruptured varicosity of the cord, and one of death caused by ulceration of the umbilical vein. He also reports instances of hematomata, cysts, and solid tumors of the cord. Very rarely, fetal death may be due to



compression of the cord around the neck, or to syphilis of the cord. As a rule, however, syphilis causes death by its direct effect on the child, and the cord lesions, when present, are rarely of such a nature as to cause interference with the circulation. In the many instances of stillbirth due to syphilis which have come under my observation, I have not in any case noted sufficient macroscopic pathology of the cord to account for the death of the fetus.

In conclusion, I wish to recommend a more careful study of the cord in cases of antenatal fetal death, as I believe that in many instances the pathologic lesion responsible for the fatality will be found there. I do not think that my cases are as rare as one would infer



Fig. 3.—Marked torsion of cord for several centimeters at fetal end.

from the scanty literature on this subject, and I trust that other members of this society will put on record similar cases that they may have observed. I wish to thank Dr. Harold Cummins, of the Department of Anatomy, Tulane University, for his assistance in the preservation and study of the specimens here presented.

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MAISON BLANCHE BLDG.

(For discussion see page 903.)

# MATERNAL AND INFANT MORTALITY IN 4488 CASES IN AN OUTDOOR CLINIC, 1922-1925\*

By HAROLD BAILEY, M.D., NEW YORK CITY

(From Cornell University Medical College in affiliation with the John E. Berwind  
Free Maternity Clinic)

THE methods of compiling maternal mortality figures differ in the various states and countries but the international code, accepted by the United States and several countries of Europe, is the best system that we have at present for recording the deaths. The maternal mortality figures for the United States are computed from the so-called Registration Area, which now consists of thirty-nine states and the District of Columbia. All but three of the southern states are included in this group, a fact that is important because the mortality in the colored women is nearly twice as high as in the white. The colored women are notably ill-constituted to bear the trials of pregnancy and labor because of their poor nutrition and the high incidence of rickets, tuberculosis and syphilis. In some regions, the latter disease affects more than a third of the women. Furthermore they are delivered by untrained midwives under conditions that lead to infection. To show how markedly these factors affect the rate, the 1922 figures of the Department of Commerce give a combined maternal death rate of 10.7 per cent for South Carolina, whereas Minnesota which has an almost entirely white population with high standards of education, has a rate of 4.9 per cent. Notwithstanding the high death rate in the colored women, the figures for the United States are close to those of Great Britain, the country with which we may most readily be compared.

TABLE I

MATERNAL MORTALITY—ENGLAND, SCOTLAND, WALES AND THE UNITED STATES,  
1921, 1922

	CRUDE RATE				ADJUSTED RATE*			
	Eng. Scot. Wales		United States		Eng. Scot. Wales		United States	
	1921	1922	1921	1922	1921	1922	1921	1922
All puerperal causes	8.1	7.2	6.6	6.5	6.9	6.0	6.7	6.6
Puerperal sepsis	3.5	2.5	2.6	2.3	3.2	2.2	2.6	2.3
Other puerperal causes	4.6	4.7	3.9	4.2	3.7	3.8	4.0	4.3

\*Adjusted rate on basis of standard 1,000,000 live births of 1917.  
(Figures obtained from census report.)

There is an element of injustice in the contention that the United States is seventeenth on the list of civilized countries in their maternal mortality rate. In order to make a comparison with other countries their methods of collecting and compiling their statistics must be thoroughly investigated, otherwise we find Russia presenting very

\*Read before a meeting of the New York County Medical Society, March, 1926.

low figures that can hardly be in conformity with the actual facts. There is so much free talk about statistical figures that one should view them with skepticism.

I present here the results of our attempt to reduce maternal deaths. The circumstances and conditions that arise in an outdoor delivery clinic are not very different from those confronting the general practitioner, and our work is described with the hope that certain applicable features may be adopted by him.

At the close of the year 1921, Cornell University Medical College formed an affiliation with the John E. Berwind Maternity Clinic,—an organization that had been giving maternity care for the past twenty years,—by which the medical control passed to the former institution. We have, therefore, four years, 1922 to 1926, in which the

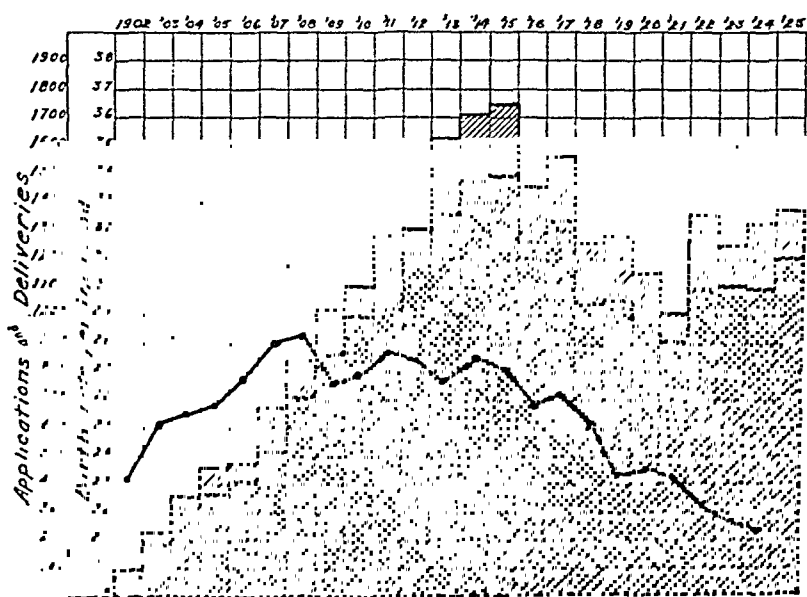


Fig. 1.—John E. Berwind Free Maternity Clinic, 1902-1925.  
Dark Area: Deliveries. Light Area: Applications. Dotted Line: Birth Rate in New York City per 1,000 Population.

clinic has been a teaching service for the Cornell Medical School and it is here that the fourth year students have obtained their practical work. This clinic is housed in a suitable building with quarters for the students and has a resident staff of four men. There are twelve nurses, including those in the maternity and infant divisions. The clinic is aided to some extent by the Henry Street Settlement whose nurses make some 4000 visits a year.

At the present time it is exceedingly difficult for any institution to keep up the number of deliveries in its outdoor clinic because, first, there is an increasing tendency for the women to seek hospital care and, secondly, due to the high cost of nursing service, the patients find it less expensive to have a private doctor than to have clinic care. We have decided that this latter cause shall not be operative in our clinic and as a result we have had a gradual but steady growth, although the birth rate in New York City is constantly decreasing.

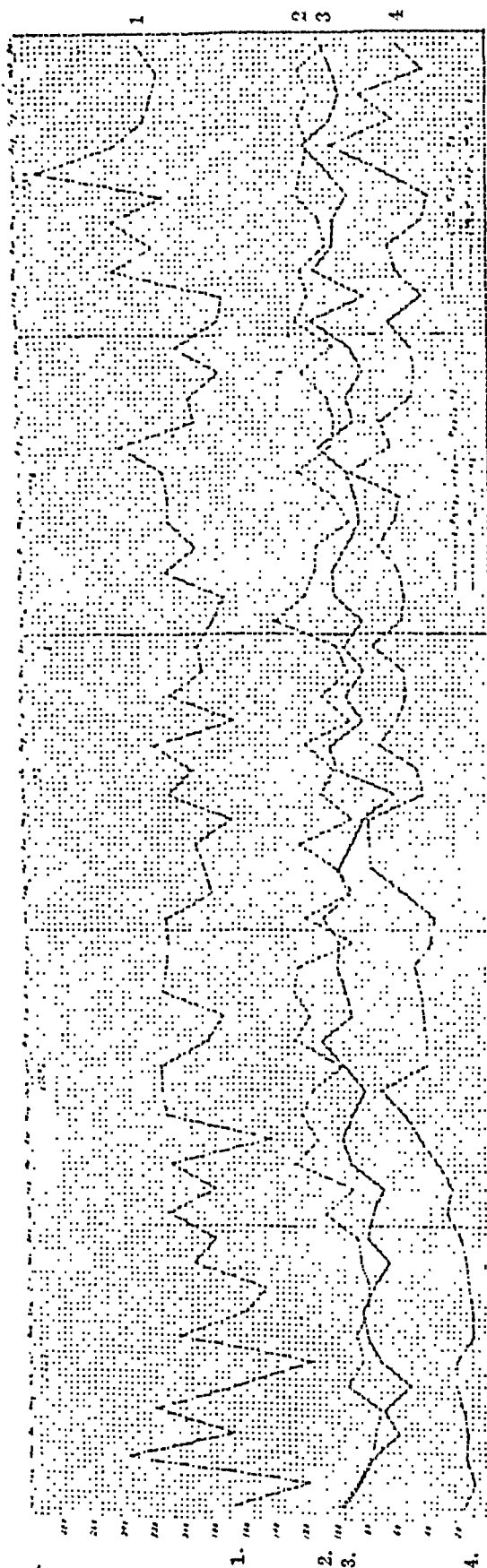


Fig. 2.—John E. Berwind Free Maternity Clinic, 1921-1925.

Chart Showing Variations in the Clinic Activities. Line 1. Number of antepartum revisits. 2. Number of applications. 3. Number of confinements. 4. Number of postpartum return visits.

Our postpartum follow-up visits are approaching the number of deliveries and the deliveries themselves are close to the applications. The total number of visits for the four years—antenatal, natal and postnatal—is 74,207; 19,294 were made by doctors and students, 41,125 by nurses and 13,788 antenatal and postnatal visits were made by the patients to the clinic. Most of the women apply for care about the seventh month, a factor that must be remembered when a study is made of our mortality figures which are lowered by the absence of deaths from abortion, ectopic pregnancies and accidents of the early months.

In addition to the antenatal and delivery care, there is a follow-up clinic and cases requiring operative repair are transferred to another of our teaching hospitals. At the end of two weeks the babies are transferred to the Pediatric Department of the clinic where they are cared for throughout one year. Forty-five per cent of our patients by actual count, are either colored or Porto Rican and, as we have pointed out, the negress is a poor maternal risk.

The principal idea of this service and the one that is applicable to general practice was ably described by A. C. Beck in his paper published in this Journal in 1923 and we believe that its adoption should be encouraged. This is that all major abnormalities should be transferred to a hospital, if possible before interference. The outdoor department of our clinic stands in relationship to a hospital that is ready to receive at all times the abnormal and emergency cases that arise in the course of the service. All major abnormalities are transferred, if possible before interference or even before labor. At first thought it might seem that this plan, if adopted by the general practitioner, would make him little more than a male midwife but the actual results show that he would still have a considerable number of operative cases. Although our maternal mortality figures are low, we believe that they could be further reduced if we had ambulance facilities to make our own transfers. As we have not been able to do this, a few of the cases have been admitted to hospitals not under our control. Our follow-up, however, includes these patients.

Students, under the direction of the resident, are permitted to make vaginal examinations, but unnecessary and repeated examinations are discouraged. Rectal examinations are not made as we believe they tend to increase sepsis through the mechanical raising, by the probing finger, of the lower part of the vaginal tract toward the open cervix. At the end of two weeks, the student usually has fourteen deliveries to his credit. In at least one-half of these he has delivered the patient himself and in the remainder he has acted as assistant. In addition to his delivery work he has attended the prenatal clinics and made postpartum calls on the patients that he has delivered.

TABLE II

BERWIND MATERNITY CLINIC FORCEPS DELIVERIES IN 4488 CASES, 1922-1925

	1922	1923	1924	1925
High Forceps	8	8	12	4
Mid Forceps	18	29	16	21
Low Forceps	14	4	19	13
Total Forceps Deliveries	166.			
Infant Deaths	23	(2 Macerated).		
Maternal Deaths	0.			

The operative work in the outdoor cases consists almost entirely of forceps deliveries, versions and procedures for the control of hemorrhage and is conducted by the resident in the presence of a member of the visiting staff. Cases for cesarean section and antenatal bleeding cases are transferred to a hospital.

In our 4488 cases there were 164 forceps procedures or an incidence of 3.6 per cent. No mothers died. The infant death rate was 12.6 per cent; but for the mid and low forceps operations it was 7.8 per cent. Perhaps some criticism might be directed toward the frequency of high forceps operations, especially as the infant death rate was 25 per cent. For the most part there were no versions following attempts at forceps delivery as we are convinced that this is not a proper procedure. Every emergency hospital receives from the outside a number of cases of ruptured uteri that are the result of version following forceps procedures. However, in an outdoor service it occasionally seems necessary to do a version after an attempt at forceps and in our few operations of this type we were fortunate in having no accidents. Our only case of ruptured uterus was one of multiple pregnancy in which the first twin was delivered by low forceps and the second by version and breech extraction.

TABLE III

BERWIND MATERNITY CLINIC BREECH DELIVERIES IN 4488 CASES, 1922-1925

	1922	1923	1924	1925
Version and Breech Extraction	19	16	13	14
Breech Extraction	2	12	8	13
Spontaneous Breech	20	38	34	37
Total Breech Deliveries	226.			
Infant Deaths	35	(7 Macerated).		
Maternal Deaths	0.			

There were 62 versions and breech extractions and, excluding macerated fetuses, the total infant mortality was 27 per cent. If these deliveries are combined with the breech extractions and the spontaneous breech deliveries, there is a total of 226 cases with a 12 per cent infant death rate.

We encountered 150 contracted pelves. Five of these cases were transferred to the hospital for cesarean section. In the remainder there were three high forceps, seven mid and low forceps and four versions. Two mothers died; one, after transfer for a cesarean sec-

TABLE IV  
BERWIND MATERNITY CLINIC ABNORMALITIES AND COMPLICATIONS IN 4488 CASES, 1922-1925

	NO. OF CASES	MATERNAL MORTALITY		NO. OF CASES	MATERNAL MORTALITY
Forceps	167 (3)	0	Toxemia	69 (13)	1
Version and Breech Extraction	62	0	Pyelitis	6	0
Breech Extraction	35	0	Prolapsed Part	25	0
Cesarean Section	5 (5)	1*	Hydramnios	4	0
Craniotomy	1 (1)	0	Thrombophlebitis	3 (1)	0
Inversion of Uterus	1 (1)	1	Sepsis	10 (9)	1
Rupture of Uterus	1	1	Sapremia	11	0
Placenta Previa	17 (11)	2	Parametritis	8 (1)	0
Premature Separation Placenta	13 (6)	1	Mastitis	16 (1)	0
Postpartum Hemorrhage	17 (4)	1	Tuberculosis	4 (3)	0
Manual Extraction Placenta	16 (3)	2	Pneumonia	2 (1)	1
Eclampsia	9 (7)	1	Cardiac Disease	7	1
			Pernicious Anemia	1	0
	344	10		166	4

\*Anesthetic Death.

(Figures in parentheses indicate number of cases transferred to hospitals.)

tion, died from the anesthesia just as the abdomen was opened and the other, from sepsis which followed manual removal of the placenta. In the 150 cases there were 6 infant deaths.

TABLE V

BERWIND MATERNITY CLINIC. INFANT DEATHS IN 4488 CASES, 1922-1925.  
RATE 5.2 PER CENT

	STILLBIRTHS	NEONATAL DEATHS
Difficult Labor		
Operative Delivery	36	12
Spontaneous Delivery	2	5
Prematurity and Injury	12	23
Congenital Abnormality	4	13
Maceration		
Death in Utero	51	0
Toxemia and Syphilis	19	0
Placental Abnormality	4	0
Cord Anomaly	9	1
Pneumonia	0	2
Atelectasis	4	6
Miscellaneous	16	16
	157—3.5%	77—1.7%

Many complications have occurred in the 4488 deliveries and we present a summary of them in order to indicate the types of cases that we have felt it desirable to transfer and also to show the end-results. In our own and the transferred cases we had 12 obstetric deaths or 1 in 374 cases,—a rate of 2.67 per 1000 live births and stillbirths. In the cases delivered by the clinic there were 7 deaths or 1 in 641 cases, giving a rate of 1.56 per 1000 live births and stillbirths. In a careful review of the deaths we feel that with improved judgment there might be even a further reduction.

TABLE VI

BERWIND MATERNITY CLINIC  
MATERNAL MORTALITY IN 4488 DELIVERIES, 1922-1925

DEATHS FROM MEDICAL COMPLICATIONS	
1 MENINGITIS	1 HEART DISEASE
OBSTETRICAL DEATHS	
<i>After Transfer to Hospital</i>	<i>Actual Mortality at Berwind</i>
1 Preclampsia. (Developed eclampsia at hospital.)	2 Manual Removal of the Placenta.
1 Placenta Previa. (Vagina packed before transfer.)	1 Sepsis. (Scarlet fever in family.)
1 Premature Separation of Placenta. (28th week. Transferred without operative interference.)	1 Chronic Nephritis and Shock.
1 Anesthetic Death. (32 hours labor at home.)	1 Placenta Previa. (Delivered in Clinic. Transferred to hospital.)
1 Inversion of Uterus. (Delivered out of service. Stopped at Clinic seeking hospital care. Transferred to hospital.)	1 Rupture of Uterus.
	1 Postpartum Hemorrhage.

Total Deaths—14 or 1 in 320 cases.

Obstetrical Deaths—12 or 1 in 374 cases—2.67 per 1000 births.

Berwind Delivery Deaths—7 or 1 in 641 cases—1.56 per 1000 births.



Our stillbirth and neonatal death rate—5.2 per cent—is not as low as we might expect and it is twice as high as the rate given by Beck in his cases in a teaching service in Brooklyn. We have listed these deaths under their direct causes as far as we could determine them and, as we were fortunate in securing a considerable number of autopsies, we feel that they are properly classified etiologically.

Some degree of infection followed in 48 cases but there were only two deaths, one mentioned above under manual extraction of the placenta and one a case of sepsis occurring in a family in which there were two cases of scarlet fever.

There were 6 complete tears that were repaired at once.

#### SUMMARY

With close control and adequate facilities a teaching service can be conducted with considerably lower death rate than that generally prevalent in the community. In our cases there is a reduction of 50 per cent below the figures for New York State. The stillbirth and neonatal death rate of 5.2 per cent is more than 30 per cent lower than the figures for New York City. We believe that these low figures are due to the transfer of the major operative cases to suitable hospitals as early in the labor as the complications become evident and to the aseptic technic in the conduct of labor.

119 EAST SEVENTY-FOURTH STREET.

### PERIODICITY OF SEX DESIRE

PART I. UNMARRIED WOMEN, COLLEGE GRADUATES

BY KATHARINE BEMENT DAVIS, PH.D., NEW YORK

*General Secretary, Bureau of Social Hygiene*

**D**URING the last few years there has been considerable study of the estrous cycle of animals. Loeb of Washington University, Stockard of Cornell, and Evans of California among others have attacked the problem from various angles.

Corner, of Rochester, has studied the relation of ovulation and menstruation in monkeys (*Macacus rhesus*). The study of the human reproductive cycle, because of the greater difficulty of approach, has not been carried so far as with the lower forms of life. A beginning, however, has been made by Schroeder, Meyer and Ruge, among others.

The importance of the study is obvious on account of its practical bearing. Menstruation, ovulation, conception, sexual desire, are all parts of it. The old notion of a "safe period" is one of the supposed contraceptive methods known to a majority of women.

Investigators in the human field, it is said, have been held back partly by lack of critical information on the psychical side—that is,

in the matter of a wave of sexual desire in women in relation to the menstrual period.

In our study of the sex life of normal women,<sup>1</sup> the questionnaires for both married and unmarried women touch upon this. The questions asked of the unmarried were more detailed and were more fully answered than those asked of the married women. The information gathered from these questionnaires is far from being as definite as desired. The comment of several of the women replying, "We should have been given a period for observation before being asked to reply," is a valid criticism. We present what there is, however, for what it is worth.

We will first consider the reports of 1000 college and university graduates unmarried and at least five years out of college.

Section III of the questionnaire, dealing with Sex Feeling and Sex Experience, begins as follows:

#### A. Sex Feeling.

1. (a) Do you recall having had any sex feelings or impulses during childhood (up to beginning of menstruation)? Spontaneous (physiologic) excitation of organs; pleasure in handling organs; desire for sex excitement; sex day dreams; curiosity about sex affairs of parents or other adults; strong attraction for boys and men; any other?
- (b) Did the appearance of menstruation arouse any feelings or emotions? What?  
Did you experience any increase in intensity or frequency of sex feelings up to college entrance?
- (c) Were such feelings increased in intensity or frequency during college course? Decreased?
- (d) Since leaving college—Increased in intensity or frequency? Decreased?
2. If you are conscious of definite sex feelings or desires do they arise at more or less regular periods? If so,
  - (a) How many marked periods of desire do you have between menstruation?
  - (b) What relations in time do they have to your menstrual period?  
During? Before? After?
  - (c) If you have more than one such wave of desire between menstruation, are they of equal or different intensity and duration?  
How far apart are they?  
How long do they continue?
  - (d) Are these periods of desire (if any) strong enough to produce temptation to sex indulgence?  
To diminish resistance to temptation?

Further questions relate to definite sex practices and experiences and the answers are discussed in part in a previous paper.<sup>2</sup>

A discussion of the answers to Section III, A-1, will be given in detail in a future paper. The first part of the present study concerns itself with questions under A-2, and their correlation with answers to questions on sex experience.

TABLE I

A-1 Entire question unanswered .....	10
Deny any sex feeling or any sex desire at any period in their lives.....	182
Admit sex feeling or desire at some period.....	808
Total .....	<u>1000</u>

These answers, however, are not always consistent with the answers to other portions of the questionnaire. Of the 10 who fail to answer question 1 in answer to questions on masturbation, two admit the practice for a short time, one as a child and one as a girl between fifteen and twenty. None of these 10 admit sex intercourse, or homosexual experience. None admit sex problems, although two fail to answer the section on problems.

Only 124 of the 182 who categorically deny any sex feeling or sex desire are consistent throughout their entire papers.

TABLE II

Deny any sex feeling or practice throughout life.....	182
Papers entirely consistent.....	124
Papers inconsistent .....	58
Of these—	
Have present sex problems.....	14
Make comments indicating sex feeling.....	9
Admit masturbation in the past.....	24
Admit masturbation at present, sex intercourse, or homosexual experience .....	11
	<u>58</u>

A brief description of the 58 inconsistent cases will be inserted in the reprint of this article because they illustrate what seems to be sex feelings which the writers are unwilling to call by that name, an attitude perhaps quite common among unmarried women of the ages covered in this study.

TABLE III  
RELATION OF ANSWERS TO A-1 AND A-2

Reply "Yes" to question A-1 .....	808
Of these in answer to A-2—	
Have observed regular periodicity.....	272
Have observed irregular periodicity.....	298
Have observed no periodicity.....	238
	<u>808</u>
Reply "No" or fail to answer question A-1.....	192
Of these—	
Question A-2 unanswered.....	99
Question A-2 No .....	93
	<u>192</u>
Total .....	1000

A glance at Table III shows that of the 808 women who answered "Yes" to question A-1, there are 238 who in answer to the first ques-

tion under A-2 say that they have never observed any periodicity of sex desire. They reply with an unqualified "No." In 298 cases a certain amount of information is given. There is a relation perhaps between the feeling of desire and the menstrual period, but it is not regular each month, or, such a desire while irregular does give rise to temptation to sex practice, etc., etc.

There are, however, 272 women who state that they have observed regular periodicity of desire. These answer the other points under A-2 as follows:

## III A-2

## (a) Number of periods of desire observed—

One period	126
One or two periods	26
Two periods	89
Two or three periods	18
Three periods	2
Three or four periods	2
Four periods	4
Four or five periods	2
"Several" periods	2
"Many" periods	1
	<u>272</u>

## (b) Relation of desire to Menstrual Period.

Those who have observed one period find it occurs—

Before menstruation .....	69
After menstruation .....	38
During menstruation .....	3
Before and during menstruation .....	9
During and after menstruation .....	3
During, between and after menstruation .....	1
Midway and after .....	2
"It may be just before or just after, but never during menstruation" .....	1
	<u>126</u>

Those who always experience one and sometimes two periods just before or just after menstruation find they occur—

Just before or just after menstruation .....	4
Just before or just after menstruation or both .....	4
Just before and occasionally after .....	2
Before sometimes, and after always .....	5
Before and occasionally during .....	1
After and occasionally during .....	1
After—no further explanation .....	2
Just before .....	3
"In between" .....	2
About 10 days after and occasionally 10 days before .....	1
The week before sometimes and a few days after .....	1

Those who always experience two periods find they occur—

Before and after menstruation.....	56
Before and during menstruation.....	8
During and just after menstruation.....	2
Both before menstruation .....	3
Both after menstruation .....	5
Just before and midway .....	4
One week before and midway.....	1
During and midway .....	2
Just after and midway.....	2
Ten days before and during menstruation.....	1
A week before and during menstruation.....	1
Just before and about 10 days before that.....	2
Just before and during (one period) and after.....	1
A week before and a week after.....	1
	<u>89</u>

Those who have observed two or three periods find they occur—

Just before and after menstruation .....	2
Before and after (a week or so apart) .....	2
Before and midway .....	1
Before and after and midway .....	1
Before usually—sometimes during .....	1
Before and after and sometimes during.....	2
Before, during and sometimes after.....	1
Before and during .....	2
Before, after and during .....	1
Before usually, during rarely—after sometimes.....	1
Just before, just after and sometimes a week later.....	1
After (no time given) .....	1
Just before, midway and sometimes during .....	1
Two or three times in the week before .....	1
	<u>18</u>

Those who have observed three or more periods find they occur—

Three periods—before, during and after.....	2
Three or four periods—before, during and after.....	2
Four periods .....	4
Weekly .....	2
Before, then others 5 to 7 days apart following.....	1
Before, after and one or two between.....	1
Four or five periods .....	2
During, after and before, 4 or 5 days apart .....	1
From a day or so before to a day or so after.....	1
“Several periods” .....	2
Beginning just after, in the week or 10 days following..	1
Usually before, occasionally after.....	1
“Many” periods several days apart throughout the month.....	1
	<u>13</u>

(c) The 120 who recognize two or more periods.

*Intensity Compared—*

Unanswered .....	47
The same .....	19
Different .....	51
Cannot tell .....	3
	<u>120</u>

*Duration Compared—*

Unanswered .....	81
Equal .....	11
Unequal .....	23
Cannot say .....	5
	<hr/> 120

*Distance Apart—*

Unanswered .....	40
Cannot say, varies .....	7
A few days .....	12
Five to seven days .....	1
A week .....	18
A week or so .....	2
A week or ten days .....	1
Ten days .....	12
Two weeks .....	21
Ten days to two weeks .....	3
One day to two weeks .....	1
Indefinite .....	2
	<hr/> 120

*Duration—*

Unanswered .....	35
Cannot say .....	3
Until satisfied .....	13
A few seconds .....	2
A few minutes .....	8
A short time .....	5
Varies with occupation .....	2
An hour or so .....	3
A few hours .....	4
A few hours to days .....	4
A day .....	3
A day or two .....	14
Several days .....	11
Two days .....	3
"Days" .....	1
A week .....	2
A week to ten days .....	1
A few minutes to 2 or 3 days .....	3
From three-quarters of an hour to a day .....	1
A few minutes to a few hours .....	1
Sometimes almost the whole interval between periods .....	1
	<hr/> 120

(d)

*Temptation to Sex Indulgence—*

Unanswered .....	33
Yes .....	119
No .....	99
Sometimes .....	13
Possibly .....	4
Formerly; not now .....	3
Reads love stories to the neglect of important duties .....	1
	<hr/> 272

*Weakens Resistance to Temptation—*

Unanswered -----	119
Yes -----	80
No -----	62
Sometimes -----	1
Possibly -----	5
In some ways -----	1
Formerly; not now -----	2
Do not know -----	2
	<hr/> 272

Of the 272 who recognize periodicity of desire, nearly one-half, or 126, state that it occurs at approximately the same time each month. In 26 instances a second period is sometimes but not always observed. In 89 cases two periods are always recognizable, while in 18 more two periods always are observed, with sometimes a third. The remaining 13 cases are scattered, lying between "three" and "many."

In the consideration of this problem the exact relationship of the desire to the menstrual period is probably the most important factor.

In textbooks on physiology and reproduction it is commonly stated that sex desire in women is strongest *after* menstruation. For example, W. H. Howell in his *Textbook of Physiology* writes: "The sexual excitement that attends the condition (heat of estrous) in lower animals is not distinctly represented in man, although it is commonly said that in the period following menstruation the sexual desire is stronger than at other times."<sup>3</sup>

Francis Hugh Adam Marshall in his *Physiology of Reproduction* makes the same statement. "The period of most acute sexual feeling is generally just *after* the close of the menstrual period."<sup>4</sup> Havelock Ellis in his *Psychology of Sex* writes: "Whatever doubt may exist as to the most frequent state of the sexual emotions during the period of menstruation, there can be no doubt whatever that immediately before and immediately after, very commonly at both times,—this varying slightly in different women,—there is usually a marked heightening of actual desire."<sup>5</sup>

Ellis quotes Kraft-Ebing who places the heightening of sexual emotion at the postmenstrual period, Adler who states that it is increased before, during and after menstruation, and Harry Campbell who as a result of certain inquiries made of their husbands who were patients at a London hospital, declares of their wives that the proportion of cases in which sexual feeling was increased before the flow, to those in which it was increased after, was as three to two.<sup>6</sup>

Marie Stopes in *Married Love* presents a chart showing "The Periodicity of Natural Desire in Healthy Women."<sup>7</sup> "Various causes make slight irregularities in the position, size and duration of the wave-crests, but the general rhythmic sequence is apparent."

In this diagram the strength of desire is shown to be the greatest in the three or four days preceding menstruation, lasting three or four days, and again from the seventh to the tenth or eleventh day following, dropping below the "level of potential desire" during the menstrual period. Miss Stopes gives no intimation of the extent of the data on which her chart is based nor of her method of obtaining them.

TABLE IV

## PERIODICITY OF DESIRE WITH REFERENCE TO THE MENSTRUAL PERIOD

NUMBER OF PERIODS	BEFORE	DURING	AFTER	"BETWEEN" OR MIDWAY	COMMENTS
One 126 cases	69 (9 and 1	3 9) <sup>1</sup> (3 and	38  3) <sup>1</sup> 1 <sup>2</sup>	3	<sup>1</sup> One period. <sup>2</sup> Either but not both.
One or two 26 cases	8  2 5 <sup>3</sup> 1 3 <sup>4</sup>  1 <sup>1</sup> 1 <sup>2</sup>	or    1 <sup>2</sup> 1 <sup>2</sup>	8 <sup>1</sup> 2 or  2 <sup>2</sup> 5  1  1 1	2 <sup>1</sup>	<sup>1</sup> One or both.  <sup>2</sup> Occasionally. <sup>3</sup> Sometimes.  <sup>4</sup> One or two waves, both before.
Two 89 cases	57 10 and  5 <sup>1</sup> 5 and (1 and	and 10 2 and  2 1) <sup>2</sup> and	57  2 5 <sup>1</sup>  and 1 2 and	5 2 2	<sup>1</sup> Both.  <sup>2</sup> One period.
Two or three 18 cases	4 1 1 1 1 1 2 1 1 <sup>2</sup> :1  1 1 <sup>6</sup>	   1 <sup>1</sup> 1 <sup>1</sup> 1 2 1 1 <sup>3</sup>  1 <sup>1</sup>	4  1  1 1 <sup>1</sup> 1 1 <sup>1</sup> 1 <sup>4</sup>  1 <sup>5</sup>	1 1      1	<sup>1</sup> Sometimes.     <sup>2</sup> Usually. <sup>3</sup> Rarely. <sup>4</sup> And sometimes a week later. <sup>5</sup> No time given. <sup>6</sup> Two or three times the week before.
Three 2 cases	2	2	2		
Three or four 2 cases	2	2	2		
Four 4 cases	2 <sup>1</sup> 1  1		2 <sup>1</sup> 1 <sup>2</sup>  1	2 <sup>1</sup>  1 <sup>3</sup>	<sup>1</sup> Weekly. <sup>2</sup> Others a few days apart. <sup>3</sup> One or two between.
Four or five 2 cases	1 <sup>1</sup>  1 <sup>2</sup>	1 <sup>1</sup>  1 <sup>2</sup>	1 <sup>1</sup>  1 <sup>2</sup>		<sup>1</sup> Beginning before, then four or five days apart. <sup>2</sup> From a day or two be- fore to a day or two after.
"Several" 2 cases	1 <sup>2</sup>		1 <sup>1</sup> 1 <sup>2</sup>		<sup>1</sup> All in the week or ten days following. <sup>2</sup> Usually all before but occasionally after.



TABLE IV—CONT'D

## PERIODICITY OF DESIRE WITH REFERENCE TO THE MENSTRUAL PERIOD

NUMBER OF PERIODS	BEFORE	DURING	AFTER	"BETWEEN" OR MIDWAY	COMMENTS
"Many" 1 <sup>1</sup>					<sup>1</sup> Several days apart throughout the month.
Total 272 Number of times mentioned	205	46	152	20	

For purposes of comparison, Table IV is arranged to show the comparative frequency with which "before," "after," "during," or "midway" is given as a period of desire in our 272 cases.

Where, for example, 8 is given in both the columns headed "before" and "after," and connected by the word "or" is meant that 8 women reply that they experience one or two periods of desire sometimes before and sometimes after the menstrual period. Where the figures are placed in two columns and connected by the word "and," it means that two periods are regularly observed in such relationships, etc., etc.

Adding the columns we find that 205 women mention "before" as the only period, or one of two or more periods observed, 46 mention "during" in the same way, while 152 give "after," and 20 "midway" as the only period, or one of two or more periods at which a regular wave of desire occurs. The proportion "before" to "after" is about 4 to 3.

Table III shows that in addition to the 272 women who recognize regular periods of desire, there were 298 who while observing certain periods of desire did not find them recurring regularly at the same time month after month.

In other words, desire occurred at "less regular intervals." In this group there were 201 women who placed their desire with reference to the menstrual period. Of these 166 women stated that they were sometimes conscious of desire but not each month. When it did come it preceded menstruation in 93 cases and followed in 40. Thirteen others said "one or two," 20 said "two" and 2 sometimes experienced from one to three such periods.

Table V presents these cases in the same manner as Table IV.

It will be observed that, taking this group as a whole, about twice as many noted the feeling as preceding the menstrual period than as following it, a proportion very much larger than that of the group exhibiting regular monthly periodicity, which as has been said was in the ratio of 4 to 3.

From the group recognizing regular monthly periodicity, we have selected for special study a group of 110 cases where the observed

TABLE V

RELATION OF DESIRE TO MENSTRUAL PERIOD OF THOSE WHO DO NOT RECOGNIZE MONTHLY PERIODICITY

	BEFORE	DURING	AFTER	"BE- TWEEN" OR MIDWAY	COMMENTS
Observe one period of desire but not regularly every month. 166 cases	93	19	40	5	
One or two periods but not regularly. 13 cases	9	or	9 <sup>1</sup>		<sup>1</sup> Either but not both.
	9 or 2 or	9 <sup>1</sup> 2			<sup>1</sup> One or both in all this group.
	1	1 or or	2	1	
May have two periods but not regularly. 20 cases	8 and	8 <sup>1</sup>			
	8	and	8		<sup>1</sup> Am not certain in these two groups. It may mean one period begun in one division and extending into next.
	1	and		1	
	(and)	3 and (and)	3 <sup>1</sup>		
One to three periods. 2 cases	2 (or)	2 (or)	2 <sup>1</sup>		
Total 201	133	44	64	7	

relation of desire to the menstrual period was stated so definitely as to make it possible to place it exactly. Of this group 59 individuals recognize one definite period of desire monthly, while 51 recognize two such periods.

Charts I and II give a graphic presentation of this data. In each chart the lunar month of twenty-eight days is represented by a large circle divided into 28 segments, one for each day. The menstrual period is fixed at the average of four days. "The week before" and "the week after" are indicated.

In Chart I the 59 small circles represent the dates given in the 59 cases of one period per month. When a statement reads "one week before," the circle is placed in the middle of the seventh segment preceding the one marked 1. If the statement reads "one or two days preceding," the circle is placed on the line dividing the appropriate segments. Where it says "the day before, lasting into the first day of the menstrual flow," two circles connected by a line indicate this condition, etc., etc.

In this group it will be noted that in all but two cases the wave of desire occurs in a period beginning with the first day of the week preceding and ending with the fourth day in the week following the menstrual period.

The group of cases presented in Chart II represents those who experience two periods of desire monthly which they place with definiteness. The same method of placement is used as in Chart I, but here

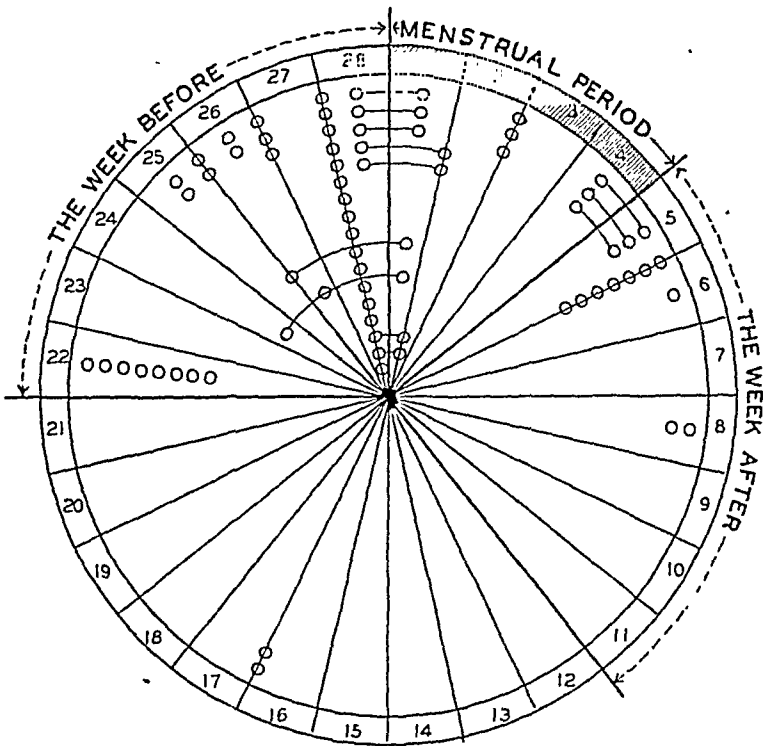


Chart I.—Frequency of sex desire. Fifty-nine cases with one period of desire monthly.

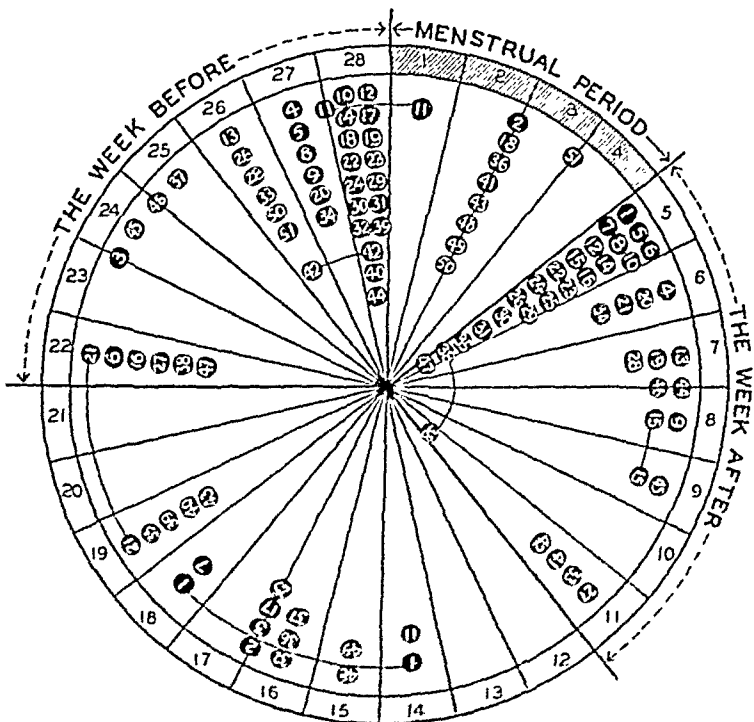


Chart II.—Frequency of sex desire. Fifty-one cases with two periods of desire monthly.

we have used black circles. The 51 cases are numbered consecutively, two circles for each case representing the two periods, e.g., Case 1 says: "Immediately following the menstrual period and from ten days to two weeks following that." Case 2 says: "Immediately fol-

lowing the menstrual period and two weeks later," etc., etc. An inspection of this chart shows only four segments free from circles.

Chart III combines the two groups, the white circles indicating the cases in group one and the black circles those in group two. On this chart only three segments are free from circles, those representing the 12th, 13th and 23rd days from the beginning of the menstrual flow. It would seem probable that with a larger group of cases, circles might

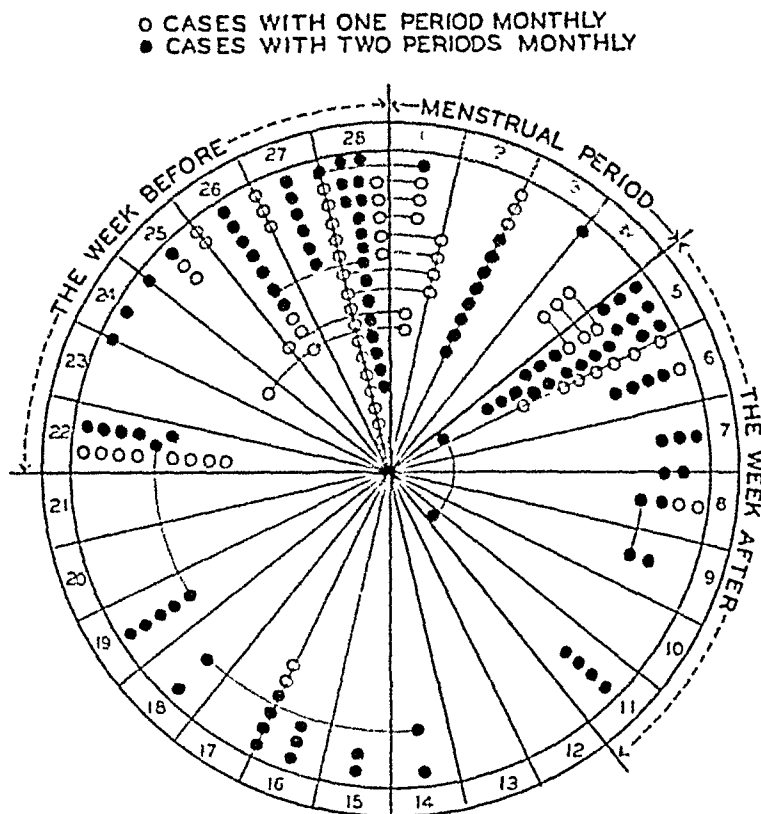


Chart III.—Frequency of sex desire. One hundred ten cases.

appear in these segments also, and thus show that on any day in the month there are individuals who experience sex desire.

Table VI summarizes the findings on Chart III.

It will be observed that the ratio of "before" to "after" is as 8 to 5. In the entire group of 272 the ratio was approximately 8 to 6 (4 to 3), while in the "irregular" group it was almost 8 to 4 (2 to 1).

TABLE VI

110 CASES WHERE PERIODICITY IS DEFINITELY PLACED

	BEFORE	DURING	AFTER	MIDWAY	COMMENTS
One period 59 cases	32 (9 and	3 (9) <sup>1</sup> (3 <sup>1</sup> and	10  3)	2	<sup>1</sup> One period
Two periods 51 cases	38 (1 and	9 1) <sup>1</sup>	37	17	<sup>1</sup> One period
Total 110	80	25	50	19	

On the whole it would appear that for this particular group of cases the proportion of "before" is considerably greater than "after," but that so far as present studies go no more definite deductions are possible.

#### CORRELATIONS

In order to discover whether the group of 272 who recognize definite periods of desire differed in any further particulars from the other groups shown in Table VII, we have worked out several sets of correlations.<sup>8</sup>

TABLE VII

1. Unanswered as to sex feeling or desire (2 admit masturbation)	10
2. No sex feeling, desire or expression	124
3. Sex feeling and sex desire admitted	594
4. Sex feeling and sex desire with periodicity	272
	<hr/> 1000

1. Age. The first comparison made was that of age. No significant differences were found between the various groups.

#### 2. First Remembrance of Sex Feelings.

A comparison of the figures shows that there was a significant difference between those who did and who did not recall sex feelings in childhood and the recognition of periodicity of desire as adults. Those who recalled sex feelings in childhood were more likely to report such recognition. It was also found that a significantly large proportion of those who do not recognize periodicity did not recognize sex feelings until after graduation from college.

#### 3. Sex Problems of Childhood.

Our questionnaire contains a section devoted to sex problems of childhood, adolescence and adult life. Inasmuch as the group which recognizes periodicity contains a significantly higher percentage of those who remember sex feelings in childhood, a comparison as to childhood problems is of interest.

By two methods of estimating, this comparison shows that a significantly larger proportion of those who recall sex problems of childhood are in the group which has *not* observed regular periodicity.

#### 4. Present Sex Problems.

The reverse is true, if we examine present problems. More than one-half, i.e., 55.9 per cent of those who recognize periodicity have present sex problems, while this is true in the case of only 43.8 per cent of those who do not. The difference is large enough to be certainly significant.

#### 5. Sex Experiences.

##### (a) Masturbation.

In the group which admits the practice of masturbation earlier in

life but has stopped the practice, there is no significant difference between those who recognize periodicity of desire and those who do not. It is otherwise with both those who state that they have never practiced it and those who admit the practice at present.

Of the 272 who recognize periodicity, only 16 per cent say they never masturbated, while 50 per cent admit the continuation of the practice; on the other hand, of the group that has never recognized periodicity, 42 per cent never practiced, while 26 per cent only practiced at time of reply.

#### (b) Homosexual and heterosexual expression.

In both of these particulars the percentage differences and the number in each group are too small to be significant.

#### 6. Health.

General health is of so great importance in the life of every woman that a correlation was made of the periodicity of desire and the state of health of the individual at the time of replying to the questionnaire.

That the women generally recognize the importance of this question is shown by the fact that only one out of the entire 1000 failed to answer. A study of the members in the respective groups, whose health at the time of answering the questionnaire was good or excellent, shows that the highest percentage is in the group of 124 individuals who deny all sex feeling and experience. The group which comes next, with so small a percentage of difference as to be negligible, is that in which the individuals recognize periodicity of desire. The group which has sex feeling but no recognition of periodicity is significantly below that which recognizes periodicity in the percentage of good and excellent health. No other percentage differences are valid.

#### 7. Nervous Breakdowns.

So-called nervous breakdowns must be the result of pathologic physical or mental conditions, or both. Under health one of the questions asked was "Have you ever had a nervous breakdown?"

Out of the total of 1000 women all but 6 answered this question. One hundred and ninety-six had had a breakdown, while 104 had "almost" or "nearly" reached that point. This together amounts to 30 per cent of the entire 1000.

If we compare the group which admit sex feeling or experience either with or without recognition of periodicity with the group which admits no sex feeling or experience, we find that the percentage of nervous breakdowns is sufficiently higher in the latter group to be certainly significant and not therefore the result of chance sampling.

Between the groups which do and do not recognize periodicity, there is no valid difference.

#### 8. Happiness.

Happiness is a purely subjective matter. It is a state of mind conditioned by a large number of factors. In most cases it has a good deal to do with efficiency,—no one denies its importance, no one has ever devised a quantitative or qualitative measurement of happiness to be applied from without.

A tabulation has been made showing how the women in the groups under consideration rate themselves.

In a questionnaire study it is impossible to go back of the statements of the persons replying. In this present study the question was put as follows:

“Do you consider your life as a whole (a) happy, (b) unhappy? In either case why?”

The highest percentage of happiness is found in the group which deny all sex feeling or experience. Next to this, and not significantly below it, comes the group with sex feelings but no observation of periodicity. The lowest percentage of happiness is in the group which recognizes periodicity, and this is sufficiently lower than that in the other two groups to be certainly significant in both cases.

#### CONCLUSION

Any interpretation of the data presented in this paper would be unscientific with only the group at hand which represents in its composition an approximately homogeneous class of women. The writer will therefore refrain, as in preceding papers, from any conclusions.

A following paper will present what material we have on the same topic taken from the questionnaires for married women. Owing, in part at least, to the form of the questions we have fewer replies and less definite information from this group. It seems wise, however, to give all we have on the subject.

#### REFERENCES

- <sup>1</sup>For the method of conducting the study, see our previous reports published in the *Journal of Social Hygiene*, April 1922, January 1923, March 1923, and *Mental Hygiene*, July 1924, January 1925.
- <sup>2</sup>A Study of Certain Auto-Erotic Practices, *Mental Hygiene*, July, 1924, January, 1925.
- <sup>3</sup>Howell, W. H.: *Textbook of Physiology*. Philadelphia and London, W. B. Saunders Company, ed. 5, 1913, p. 949.
- <sup>4</sup>Marshall, Francis Hugh Adams: *The Physiology of Reproduction*, New York, Longmans, Green & Co., 1922, p. 138.
- <sup>5</sup>Ellis, Havelock: *Studies in the Psychology of Sex*. Vol. I. Philadelphia, F. A. Davis Company, ed. 3, 1923, p. 103.
- <sup>6</sup>Loc. cit.: p. 104.
- <sup>7</sup>Stopes, Marie Carmichael: *Married Love, A New Contribution to Sex Difficulties*, London, G. P. Putnam's Sons, ed. 12, 1923, p. 68, Chart I.
- <sup>8</sup>A detailed discussion of these correlations together with the supporting tables will be found in the reprint. The method of comparison is that used in previous studies. See a Study of Certain Auto-Erotic Practices, *Mental Hygiene*, July, 1924, viii, No. 3, p. 878.

# THE EFFECT OF TREATMENT OF THE SYPHILITIC PREGNANT WOMAN UPON THE INCIDENCE OF CONGENITAL SYPHILIS\*

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*(Contribution from the Evans Memorial)*

THE development of the dispensary clinic with its early diagnosis and prompt treatment has diminished the spread of syphilis from a public health standpoint by shortening the infectious period and by reducing the number of patients capable of transmitting syphilis. However, its suppression must depend upon more extensive measures for the removal of the sources of infection. An important means of combating the spread of this disease is the treatment of congenital syphilis, which is accomplished not only by the treatment of the syphilitic child after birth, but also indirectly by the treatment of the syphilitic pregnant woman.

Although opinions differ as to its efficacy, the treatment of children with congenital syphilis is generally considered inadequate inasmuch as it is limited to the children who survive the first few weeks of life. On the other hand, since antenatal treatment of the mother during the gestation period not only affords an opportunity for treatment of the child in utero and serves as a prophylactic measure against infection of the child, but also renders the mother noninfective to future offspring, it appears to be the most practical means of attacking the problem of congenital syphilis. The efficacy of this method of treating congenital syphilis as measured by the production of healthy living children is confirmed by numerous reports in medical literature. Since few of these reports have submitted a control series of untreated syphilitic women, it is my purpose to present a statistical survey of one hundred and ninety women with positive Wassermann reactions, of whom forty had received treatment during the gestation period, and to point out some of the factors which, independent of treatment, influence the results. Before interpreting these figures, it is necessary to consider the method of infecting the offspring, the ways in which syphilis injures the child, and the variable factors which render the statistics upon congenital syphilis confusing.

## TRANSMISSION OF CONGENITAL SYPHILIS

Not infrequently one partner of a marriage is nonsyphilitic and the other syphilitic. The type and duration of the disease, the organs chiefly affected, and the treatment previous to marriage determine the incidence of transmission between husband and wife. The occasional instances of apparently symptomless and serum-negative mothers of syph-

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\*Presented at a meeting of the Obstetrical Society of Philadelphia, March 4, 1926.



ilitic children cannot be explained by the factors which determine the absence of conjugal syphilis. Although the possibility of the paternal transmission without maternal infection offers a fertile field for speculation, it is more reasonable to assume that every child with congenital syphilis has a syphilitic mother and that the serum-negative mother with no clinical symptoms has an unrecognized syphilitic infection.

The so-called congenital syphilitic child may acquire the disease during the antenatal, intranatal, or postnatal period. In the last instance, syphilis acquired after birth is classified erroneously as congenital. Syphilis may be acquired by the child during labor if the parturient canal is infected with the treponema. Most children with congenital syphilis become infected during the antenatal period. The mother may be infected before or during pregnancy. The time of infection and the element of chance determine in no small measure the incidence of congenital syphilis. Exacerbation of the disease, local infection of the reproductive tract, abnormalities which lower the protective powers of the fetus, and changes in the resistance of the mother are among the factors which determine whether the child be syphilitic or healthy.

*Previous to Conception.*—The greater the interval between the infection and conception, the smaller are the chances of infecting the child. Women in whom the disease has been recently active give the highest incidence of infected children. In untreated persons acquired syphilis tends to become latent, though retrogression is irregular. Exacerbations of the disease and temporary alterations in individual immunity may result in an irregular distribution of healthy and syphilitic children in the same mother. With these exceptions it may be stated that women who show no clinical evidence of syphilis and who have had the disease over five years seldom give birth to a syphilitic child. The syphilitic population of maternity hospitals is composed largely of such women.

*During Pregnancy.*—The critical period of infection is just previous to conception and during the first five months of pregnancy. Syphilis acquired by the mother during the last months of pregnancy is less likely to result in intrauterine infection, especially after the seventh month, but occasionally is transmitted by the intranatal or postnatal route. The possibility that the ovum may be infected at conception and subsequently may infect the mother must also be considered. Clinical experience and experimental work in animals indicate that pregnancy alters the clinical course of syphilis. The state of pregnancy may serve as a protective function which alters the ordinary course of the conflict between host and disease.

#### INJURIOUS EFFECTS OF SYPHILIS

In order to record the effect of antenatal treatment, it is necessary to know the injurious effects of syphilis upon the child. Syphilis may manifest itself in fetal deaths, premature births, children dying soon

after birth, and in living syphilitic children. Its general effect is to lower the productive power as measured by the ratio of living children to total conceptions. The percentage of living births and the survival of these children are noticeably lower in women with serum-positive syphilis than in nonsyphilitic women. A strongly positive Wassermann reaction, recent syphilis and clinical symptoms increase the destructive effect.

*Fetal Deaths.*—The surprisingly small rôle played by syphilis in the totality of fetal deaths is due to the difficulty of determining accurately its action, its relative infrequency, and the fact that its maximum activity is not evident until the later months of pregnancy. Our statistics indicate that about 15 per cent of women who give a history of abortions or stillbirths have a positive Wassermann reaction, and that one-third of all fetal deaths in serum-positive syphilitic women and two-thirds in women with clinical syphilis are due to syphilis. Certain races, as the Negro, have a higher percentage of syphilitic fetal deaths.

Since the action of syphilis is practically confined to the later months of pregnancy, a record of stillbirths in maternity hospitals affords considerable information as to the effect of syphilis. However, the abnormal proportion of difficult or complicated cases which require hospital care lowers the per cent due to syphilis. In a series of nearly five hundred serum-positive syphilitic women, two-fifths of the hospital stillbirths were due to syphilis.

*Early Deaths.*—Since syphilis tends to produce weak or premature children, the combined statistics of stillbirths and children dying within two weeks are more representative of its effect than stillbirths alone. According to our statistics, 1.47 times as many fatalities occur in children of serum-positive syphilitic women as in those of nonsyphilitic and 3.87 times as many in those of clinically syphilitic women.

The cause of fetal and early death may be grouped under mechanism of labor,  $\frac{1}{6}$  (suffocation, dystocia, and placental abnormalities); condition of mother,  $\frac{1}{12}$ ; condition of the child,  $\frac{1}{4}$  (prematurity, inanition, debility, and deformity in some instances indirectly due to syphilis); recognizable syphilis and macerated fetuses,  $\frac{1}{4}$ ; and various and unknown causes,  $\frac{1}{4}$ . Syphilis often produces a macerated fetus but other conditions may accomplish the same result and the designation of syphilitic should not be applied without morphologic evidence of the disease or the presence of treponema. The similarity of causes of fetal deaths in syphilitic and nonsyphilitic women indicates that syphilis may act indirectly by lowering the general resistance, thus rendering the fetus susceptible to conditions otherwise insufficient to produce death.

*Effect on Child.*—The general effect of maternal syphilis upon the child may be roughly obtained by a follow-up record of the children of syphilitic women. Such surveys as a rule furnish only minimum

figures as to the effect of syphilis. The majority of women with positive Wassermann reactions during pregnancy have inactive old syphilis. Nonsyphilitic individuals may be included through technical errors and it is impossible even with a careful physical examination to exclude the presence of syphilis in the apparently healthy children. In a series of 374 untreated serum-positive women about 66 per cent of the children were apparently healthy and free from syphilis.

#### VARIABLES INFLUENCING STATISTICS UPON CONGENITAL SYPHILIS

The statistical discrepancies as to the effect of syphilis upon the child are the result of certain variable factors. For example, the incidence of congenital syphilis is quite different in the children of women who have only a positive Wassermann reaction and in those of women who show in addition clinical evidence of syphilis. The Wassermann reaction in the pregnant woman presents certain peculiarities and active syphilis in the mother produces a greater effect on the offspring than latent syphilis. Obviously, it is unfair to compare statistics based on clinical findings with those based upon the Wassermann reaction. An adequate comparison between two groups of women with positive Wassermann reactions requires that they have a similar composition as to race and marital history, clinical syphilis, duration of the disease, and previous treatment.

*Wassermann Reaction.*—Opinions vary as to the reliability of the Wassermann reaction during pregnancy, but these irregularities are chiefly the result of technical procedures, prominent among which are the type of antigen and the method of handling the serum. Cholesterolized antigens give different results from noncholesterolized antigens, particularly with pregnant women. When no special care is taken in handling the serum, anticomplementary and even nonsyphilitic fixation substances may develop in the serum, which in pregnant women seems to possess an instability that renders it more susceptible than ordinary serum to abnormal conditions of handling. Owing to technical irregularities, a group of women with positive Wassermann reactions may include a certain number of nonsyphilitic women and may not be comparable to a group of clinically syphilitic women. Unless tests were made with the same antigen and with the same methods of handling the sera, even two groups of women with positive reactions would not be comparable.

*Clinical Syphilis.*—The presence of a positive Wassermann reaction in pregnant women may indicate a nonsyphilitic condition due to a false reaction, old "cured" syphilis of inactive type, treated syphilis, and symptomless syphilis. Only the last class, representing an infection with no external manifestation, is especially dangerous to the offspring. Therefore, syphilis should have less effect upon the children of serum-positive women than upon those of women with clinical evi-

dence of syphilis. The type of clinical syphilis determines in a large measure the effect upon the offspring. Recent syphilis tends to give more disastrous results than old; florid syphilis is more serious than inactive; untreated is more dangerous than treated; syphilis in non-resistant women has more effect on the child than syphilis in resistant women; and syphilis in certain races tends to exact a greater toll upon the children. By unconsciously attributing the serious effect of recent active maternal syphilis in the child to all stages of syphilis, both the damage from this disease and the beneficial effects of treatment have been exaggerated.

#### TREATMENT OF THE SYPHILITIC PREGNANT WOMAN

If allowance is made for the factors which influence the transmission of congenital syphilis, the effect of antenatal treatment of the mother may be observed by comparing groups of untreated and treated women. Our statistics are based upon women who presented either a strongly positive Wassermann reaction with a cholesterolized antigen during pregnancy or, in addition, clinical evidence of syphilis. Follow-up records on the children between the ages of one and four years are presented for forty women who had received antisyphilitic treatment before delivery and for one hundred and fifty who had received practically no treatment. Both groups, more particularly the untreated, may contain some nonsyphilitic women, since many Wassermann reactions previously positive were found to be negative at the time of the survey, although the subsequent negative reaction may be due in part to the lapse of time, the absence of pregnancy, and antisyphilitic treatment. The small number of women who received adequate treatment previous to delivery is explained by the fact that many women did not report for prenatal examination sufficiently early to permit adequate treatment and that at the time these statistics were taken, 1916 to 1919, the present methods of thorough prenatal syphilitic treatment were not in vogue.

Before a fair comparison of the effect of treatment can be made, it is necessary to determine whether the two groups of patients are similar in other respects than possessing a positive Wassermann reaction.

*Clinical Syphilis.*—In Table I the two groups have been divided from the standpoint of clinical syphilis into four classes: (A) *definite*, when there is no question of the clinical diagnosis; (B) *suspicious*, when there are several suggestive symptoms but the evidence is not conclusive; (C) *suggestive*, when a single symptom or sign of the disease is present; and (D) *no indication*, when no clinical evidence can be obtained. A relatively small proportion of women with serum-positive syphilis give clinical evidence of the disease in prenatal clinics. The number of women with clinical syphilis is greater in these groups than

usually noted in our prenatal clinic since a special effort has been made to obtain additional evidence through the family. As a rule, multiparae present more clinical evidence of syphilis than primiparae, but since the proportion of multiparae is approximately the same in both groups, it does not affect either the clinical classification or later the results with the present child.

TABLE I  
CLINICAL CLASSIFICATION

CLINICAL SYPHILIS	NEGATIVE	POSITIVE		
		UNTREATED	TREATED	TOTAL
Number of patients	500	150	40	190
Multiparae	277	106	26	132
Primiparae	223	44	14	58
A. Definite	0.2%	24%	37.5%	26.3%
B. Suspicious	11.8	34	30.0	33.2
C. Suggestive	30.0	24	15.0	22.1
D. No Indication	58.0	18	17.5	18.4

Arbitrarily the A and B classes are taken as indicating clinical syphilis irrespective of the actual type or stage of the disease. Patients with clinical syphilis form 58 per cent of the untreated group and 67.5 per cent of the treated. If the evidence obtained from the child of the present pregnancy is excluded, the difference is more pronounced, 36 per cent and 60 per cent respectively. Also the disease had existed over five years in 42.5 per cent of the untreated women as compared with 30.0 per cent of the treated. Since the treated group evidently is more severely afflicted with syphilis, it is not comparable clinically with the untreated.

*Previous Children.*—In multiparae the results of previous conceptions give additional information as to the severity of the infection. Our statistics indicate that over one-half the fetal deaths in these patients were the result of syphilis. Table II shows the severe effect of syphilis in the treated group in respect to fetal deaths and dead children. The influence of clinical syphilis is particularly evident in the untreated group in which forty-three serum-positive multiparae had a previous history of 16 per cent of fetal deaths as compared with 44.3 per cent for sixty-three multiparae who once had clinical symptoms of syphilis. In the treated group little difference was observed between the serum-positive and clinically positive women who gave 50 and 53 per cent of fetal deaths respectively. This difference suggests that possibly some of the patients without clinical symptoms in the untreated group were nonsyphilitic.

The treated group comprised a larger proportion of clinically syphilitic and more recently infected women than the untreated group, and these women had suffered more damage with their previous children. If both groups had remained untreated, it would be natural to

TABLE II  
 PREVIOUS CHILDREN

	NEGATIVE	POSITIVE		
		UNTREATED	TREATED	TOTAL
Number of multiparae	277	106	26	132
Number of conceptions	610	281	58	339
Per cent fetal deaths	19.5	34.2	51.7	37.2
Per cent dead children	10.8	12.1	19.0	13.3
Per cent living children	69.7	53.7	29.3	49.5

expect that the unfavorable results in the present child would be more marked in the treated group. According to present standards the treated patients received insufficient prenatal treatment, approximately six injections of arsphenamine and twelve of mercury. In comparing the two groups, due allowance must be made for these differences. The eighty-seven women of the untreated group who had clinical evidence of syphilis perhaps more nearly represent the average effect of untreated syphilis. For this reason, our results for the untreated control group are expressed for both clinical and serum-positive women.

 TABLE III  
 PRESENT CHILD

	NON-SYPHILITIC WOMEN	SYPHILITIC WOMEN			
		UNTREATED			TREATED
		CLINICAL	NON-CLINICAL	TOTAL	
Total conceptions	492	87	63	150	40
Dead children					
Per cent					
Fetal deaths	3.7	23.0	7.9	16.7	5.0
Dying in Hospital	2.6	6.9	1.6	4.7	7.5
Dying after Hospital		15.0	3.1	10.0	
Total		44.9	12.6	31.4	27.5
Living children					15.0
Per cent					
Syphilitic		12.7	0.0	7.3	5.0
Nonsyphilitic		42.4	87.4	61.3	67.5
Total		55.1	87.4	68.6	72.5

*Present Child.*—In the untreated and treated groups in Table III 61.3 per cent and 67.5 per cent respectively of the conceptions resulted in nonsyphilitic children,—a slight increase in favor of the treated group. This observation applies only to children from one to four years of age showing no evidence of early syphilis and naturally the percentage may include children who later may show evidence of the

disease. In 87 untreated women with clinical syphilis 42.4 per cent of the conceptions terminated in apparently healthy children as compared with 87.4 per cent in 63 serum-positive women. The difference is similar but less marked, 49 and 68 per cent respectively, when the clinical classification does not include evidence in the present child. In the untreated group 47.6 per cent of the conceptions in 44 primiparae produced nonsyphilitic living children and in 106 multiparae 67 per cent, indicating that other factors than syphilis tend to increase the mortality in primiparae. Primiparae also give a greater proportion of stillbirths than multiparae. The damaging effect of recent untreated syphilis is illustrated by the fact that in 105 women with syphilis of less than five years' duration, living nonsyphilitic children were obtained in 56 per cent of the conceptions in contrast to 73 per cent in 45 women with syphilis of over five years' duration.

The treated group showed fewer fetal deaths, 5 per cent, than the untreated group, 16.7 per cent, the highest percentage, 23 per cent, occurring in the clinical section of the untreated group. By its tendency to produce premature birth and faulty development, syphilis increases the number of children dying shortly after birth, particularly within the first two weeks. Our treated group showed a greater proportion of such accidents than the untreated and the nonsyphilitic groups, but the combined total of fetal deaths and deaths during the first two weeks of life was but slightly over one-half that of the untreated group. The death rate after leaving the hospital was practically the same in the untreated women with clinical syphilis and the treated women, approximating the normal death rate, which was 15.1 per cent, for children less than one year old in the registration area during this period. The low death rate for the serum-positive untreated women is probably due to statistical variation.

#### DISCUSSION

These somewhat meager statistics indicate that a large proportion of the children born of untreated syphilitic women never develop syphilis. The transmission of congenital syphilis depends upon the type and duration of the disease in the untreated mother, upon her resistance, and to a limited extent upon the element of chance. At least some of the excellent results attributed to antisymphilitic treatment in the literature would have been obtained without treatment if the investigation had been controlled by a series of untreated patients. The results of antisymphilitic treatment, which are so effective in recent active syphilis, cannot be interpreted in the same manner in old or latent syphilis, which is less frequently transmitted from mother to child.

In recent active syphilis, treatment is absolutely necessary to prevent infection of the child. In old or obscure syphilis there is always

the possibility of transmission and, therefore, it is essential that treatment be instituted in every pregnant woman with a diagnosis of syphilis. Treatment of the pregnant woman should be begun early, should be thorough, and should be continued up to the time of delivery.

#### SUMMARY

A survey of the children of untreated women who had a positive Wassermann reaction during pregnancy indicated that the majority of these children showed no evidence of early congenital syphilis. In 150 serum-positive women who received no treatment during pregnancy 61.3 per cent of the conceptions resulted in living, apparently nonsyphilitic children; in 87, who in addition showed evidence of clinical syphilis, 42.4 per cent; and in 63 who had only serum-positive syphilis 87.4 per cent. Women who showed no clinical evidence of syphilis and who had had the disease over five years seldom gave birth to a syphilitic child.

A group of 40 women who resembled most closely the 87 untreated women with clinical syphilis in respect to the previous effect of the disease received antisymphilitic treatment during the gestation period. Living, apparently nonsyphilitic children resulted in 67.5 per cent of the conceptions. The most striking evidence of the effect of treatment was the lowering of the fetal death rate.

(For discussion see page 898.)

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### PLACENTAL TRANSMISSION

#### IV. THE PROTEIN FRACTIONS IN FETAL AND MATERNAL PLASMA

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**A**N INTEREST in the general subject of placental transmission has led us to investigate the relation between the concentrations of the various protein fractions in the fetal plasma as compared with those obtaining in the maternal plasma at the time of parturition. This interest was accentuated by the fact that we have shown recently that the amino-acids are constantly higher in the fetal whole blood and plasma than in the maternal.<sup>1</sup>

Previous workers,—Landsberg,<sup>2</sup> Zangemeister and Meissl,<sup>3</sup> Alder,<sup>4</sup> and Bauereisen<sup>5</sup>—have demonstrated that the total proteins are higher in the plasma and serum of the newborn than in the mother; while others—Utheim,<sup>6</sup> Lederer,<sup>7</sup> and Boyd<sup>8</sup>—have shown that newborn infants and very young children have a lower plasma or serum protein content than older children and normal adults. Landsberg<sup>2</sup> has also shown by actual analysis that the plasma of the newborn child has a lower fibrinogen (fibrin) content than that of its mother, and the same conclusion was



reached by Krüger<sup>9</sup> and Scherenziss<sup>10</sup> upon the basis of determinations of the fibrin in fetal plasma as compared with the published figures for that in normal adults. Kollmann<sup>11</sup> found identical values in the mother and child in one case of eclampsia,—0.75 per cent in each. Duzár and Rusznyák<sup>12</sup> report that the fibrin content of the blood and plasma of young children is below the commonly accepted normal.

The albumin and globulin fractions have been less studied, but Duzár and Rusznyák<sup>12</sup> say that, "The blood of a newborn babe is . . . , rich in globulin and total albumin; . . . ."; and Alder<sup>4</sup> maintains that placental serum contains, as a rule, less protein and a higher proportion of albumin than adult blood. Lewis and Wells<sup>13</sup> fractionated the globulins in the blood of several normal adults and in a few specimens of cord blood, and found that, "the newborn human infant is virtually devoid of euglobulin in its blood serum, although it has quite as much serum albumin and about the same quantity of pseudoglobulin as the adult." Howe<sup>14</sup> has shown that newborn calves have neither euglobulin nor pseudoglobulin I in the blood, but that these substances make their appearance a few hours after birth if the animal obtains colostrum from its mother, or more slowly if it is fed milk from a cow which has been lactating for some months. Colostrum is particularly rich in euglobulin.

In a recent communication,<sup>15</sup> we have stressed the fact that the values for the various plasma protein fractions available in the literature are too different to be of much consequence, and that such figures are comparable only when the analyses have been done by the same method. A similar divergence of opinion exists as to what changes are produced by pregnancy in the normal individual. Our own determinations<sup>15</sup> indicate that gestation causes a lowering of the total protein which is due to a diminution in the serum albumin, with the serum globulin showing no distinct alteration, and the fibrin rising from early in pregnancy to a high point on the third day after delivery.

#### METHODS

The blood specimens were collected into test tubes containing 35 milligrams of powdered potassium oxalate; the maternal specimen from an arm vein and the fetal from the free cut maternal end of the umbilical cord immediately after the birth of the child. From 10 to 15 cubic centimeters of blood were taken in each instance so that the proportion of oxalate was fairly constant. No attention was paid to the time of the last meal either in the parturient women or in the normal nonpregnant individuals, since Alder<sup>4</sup> has shown that food intake has little or no effect upon the protein composition of the blood. Care was taken to have a minimal amount of venous stasis. All specimens showing any clotting or any considerable degree of hemolysis were discarded. It is extremely difficult by this simple

method to obtain fetal plasma which is perfectly clear, but we convinced ourselves that a small amount of hemoglobin has no appreciable effect upon the results. After centrifugalizing the specimens for twenty minutes at 2500 to 3000 r.p.m., the supernatant plasma was removed and analyzed by the method of Wu,<sup>16</sup> which was followed without change. All bloods were collected only during the day when analysis could be begun at once.

## RESULTS

Table I gives the values obtained in 15 normal, nonpregnant, young women which may serve for comparison with the fetal and maternal figures which form the chief part of this communication.

TABLE I  
THE PLASMA PROTEIN FRACTIONS IN NORMAL NONPREGNANT WOMEN

CASE NO.	PLASMA VOLUME %	TOTAL PROTEIN %	ALBUMIN %	GLOBULIN %	PLASMA FIBRIN %	W. B. FIBRIN %	REMARKS
2	64.6	7.78	5.02	2.39	0.37	0.24	15 days after period
33	65.4	6.96	4.06	2.65	0.25	0.16	2nd day of period
43	74.1	7.21	4.45	2.32	0.34	0.25	1st day of period
112	68.9	7.63	4.40	2.92	0.31	0.21	20 days after period
113	66.3	7.74	4.66	2.77	0.31	0.21	14th day of period
114	67.1	7.58	4.35	2.95	0.28	0.19	7 days after period
115	66.4	7.04	4.23	2.57	0.24	0.16	20 days after period
124	66.1	7.50	4.18	2.92	0.40	0.26	3rd day of period
126	67.7	7.60	4.30	3.07	0.23	0.16	23 days after period
133	61.7	7.73	4.53	2.87	0.33	0.20	26 days after period
138	62.5	7.35	4.45	2.60	0.30	0.19	27 days after period
178	60.0	7.08	4.33	2.44	0.31	0.19	4th day of period
346	66.9	7.26	4.51	2.39	0.36	0.24	28 days after period
359	65.1	7.61	4.33	3.00	0.28	0.18	14 days after period
379	62.5	7.32	4.56	2.47	0.29	0.18	16 days after period
Aver.	65.7	7.42	4.42	2.69	0.31	0.20	

The average value for total plasma protein,—7.42 per cent,—compares well with that previously reported by Plass and Bogert<sup>17</sup> for 22 normal nonpregnant women,—7.04 per cent. Our experience is that the Wu method generally gives values slightly higher than those obtained by the older Kjeldahl procedure. There does not seem to be any definite relation between the total plasma protein content and the menstrual cycle. The albumin and globulin figures correspond well with those generally given but the former is somewhat lower and the latter somewhat higher than those of Coetzee<sup>18</sup> and Wu.<sup>16</sup> The fibrin values compare well with those of other investigators. It would appear that the fibrin tends to be somewhat higher at or about the menstrual period, as suggested by Frisch and Starlinger,<sup>19</sup> although more extensive work would be necessary to establish this point. Such an observation agrees well with that of Löhr<sup>20</sup> and others that during menstruation the suspension-stability of the blood is

appreciably diminished. It has already been established by Gram<sup>21</sup> that women generally have a higher plasma fibrin than men.

Table II gives the total protein values obtained in 15 samples of fetal and maternal plasma.

TABLE II  
THE TOTAL PROTEINS IN FETAL AND MATERNAL PLASMA  
(VALUES IN GRAMS PER 100 C.C.)

CASE NO.	FETAL	MATERNAL	CASE NO.	FETAL	MATERNAL
1	6.37	7.43	9	6.75	7.30
2	5.60	6.70	10	5.56	7.52
3	5.67	7.22	11	6.03	6.45
4	6.42	7.27	12	6.12	6.91
5	6.97	7.02	13	6.34	7.66
6	6.26	7.13	14	6.61	7.98
7	6.00	6.60	15	6.66	7.62
8	5.40	7.01	Average	6.18	7.18

The total plasma protein was consistently higher in the child than in the mother, the range of difference being from 0.05 to 1.96 per cent and the average variation 1.00 per cent. Corresponding figures from other sources follow:

	FETAL		MATERNAL		AVERAGE DIFFERENCE
	NO. OF CASES	PROTEIN PER CENT	NO. OF CASES	PROTEIN PER CENT	
Zangemeister and Meissl <sup>3</sup>	7	5.16	7	6.79	1.63
Landsberg <sup>2</sup>	6	5.05	6	6.57	1.52
Bauereisen <sup>5</sup>	15	5.80	7	6.84	1.04

The maternal values at the end of labor are thus seen to be slightly below those previously given for normal, nonpregnant, young women. The fetal values are, however, more markedly depressed. Uthelm<sup>6</sup> and Lederer<sup>7</sup> have recorded average values of 4.84 and 5.07 per cent for the plasma proteins in premature infants, so that it appears that the protein content of the plasma varies somewhat with the period of intrauterine development. We were, however, unable to detect any relationship between the plasma protein concentrations in the mature infants we studied and their birth weights.

Table III records the serum albumin values obtained in the 15 cases studied.

TABLE III  
THE SERUM ALBUMIN IN FETAL AND MATERNAL PLASMA  
(VALUES IN GRAMS PER 100 C.C.)

CASE NO.	FETAL	MATERNAL	CASE NO.	FETAL	MATERNAL
1	4.20	4.20	9	4.10	4.28
2	3.35	4.10	10	3.44	3.96
3	2.97	3.74	11	3.51	3.71
4	3.58	4.01	12	3.80	4.10
5	4.09	3.97	13	3.77	4.09
6	3.71	3.94	14	3.97	4.51
7	3.64	3.96	15	3.97	4.53
8	3.32	3.56	Average	3.69	4.04

The average albumin content of fetal plasma is somewhat lower than that of maternal plasma (3.69 per cent against 4.04 per cent), but the individual samples are not absolutely consistent in this respect, for in one instance the maternal specimen is slightly lower and in another the two samples are equal in albumin content. Possibly these variations were due to unintentional stasis in the cord blood resulting from compression of the vessels even before the birth of the child.

Alder<sup>4</sup> seems to have found the fetal serum high in albumin since he reports that it represents 77.1 per cent of the total protein in 21 placental blood samples as against 69.0 per cent in 24 normal women, although it may have been that the relative value only was increased, for he found the total proteins lower in the placental specimens than in normal adults. Boyd<sup>5</sup> reports the average albumin in the serum from cord blood as 2.60 per cent (using her nitrogen values and a conversion factor of 6.25), and the average globulin as 2.14 per cent, the albumin thus representing 55 per cent of the total protein.

Table IV gives our serum globulin values.

TABLE IV  
THE SERUM GLOBULIN IN FETAL AND MATERNAL PLASMA

CASE NO.	FETAL	MATERNAL	CASE NO.	FETAL	MATERNAL
1	1.86	2.62	9	2.39	2.57
2	1.99	2.24	10	1.84	3.15
3	2.49	3.10	11	2.29	2.32
4	2.49	2.77	12	2.09	2.49
5	2.60	2.72	13	2.32	3.05
6	2.29	2.67	14	2.39	3.07
7	2.07	2.29	15	2.29	2.62
8	1.84	2.95	Average	2.22	2.71

In every instance the globulin in the fetal plasma is less than in the maternal blood. The average difference is 0.49 per cent, while the extremes are 0.03 and 1.31 per cent. The maternal values are practically the same as those for normal, nonpregnant women, while in the newborn children the globulin is considerably lowered. This confirms Lewis and Wells,<sup>13</sup> who found that adult blood serum averaged 3.60 per cent globulin as against 2.18 per cent for the serum obtained from cord blood, the latter value agreeing well with that here reported. Fähræus<sup>22</sup> says: “\* \* \* the lowest globulin values are to be found in the newborn, where, as we have seen, the stability is greatest.” On the other hand, Duzár and Rusznyák<sup>12</sup> state that: “The blood of a newborn babe is \* \*, rich in globulin \* \*.”

Table V presents the fibrin (fibrinogen) values.

The average value for the fibrin at birth is only slightly lower than in normal adult women even though it is considerably lower than in the parturient woman. In every instance the difference is in this

TABLE V

THE FIBRIN IN FETAL AND MATERNAL PLASMA  
(VALUES IN GRAMS PER 100 C.C.)

CASE NO.	FETAL	MATERNAL	CASE NO.	FETAL	MATERNAL
1	0.31	0.64	9	0.26	0.45
2	0.26	0.36	10	0.28	0.41
3	0.21	0.38	11	0.23	0.42
4	0.35	0.49	12	0.23	0.32
5	0.28	0.33	13	0.25	0.52
6	0.26	0.52	14	0.25	0.40
7	0.29	0.35	15	0.40	0.47
8	0.24	0.50	Average	0.27	0.44

direction. Landsberg<sup>2</sup> gives an average value of 0.24 per cent for the newborn as against a nonpregnant adult figure of 0.38 per cent; while Duzár and Rusznyák<sup>12</sup> say that: "The blood of a newborn babe is very low in fibrinogen \* \* \*"

When the whole blood fibrin is calculated from the plasma fibrin values and the plasma volume per cent as recommended by Foster and Whipple<sup>23</sup> values represented in Table VI are obtained:

TABLE VI

THE FIBRIN IN FETAL AND MATERNAL WHOLE BLOOD

CASE NO.	PLASMA VOLUME		PLASMA FIBRIN		WHOLE BLOOD FIBRIN	
	Fetal %	Maternal %	Fetal %	Maternal %	Fetal %	Maternal %
1	50.0	67.3	0.31	0.64	0.15	0.43
2	55.3	62.0	0.26	0.36	0.14	0.22
3	50.6	64.0	0.21	0.38	0.11	0.24
4	51.3	62.0	0.35	0.49	0.18	0.30
5	48.0	68.3	0.28	0.33	0.14	0.23
6	55.3	68.7	0.26	0.52	0.14	0.38
7	53.0	70.3	0.29	0.35	0.15	0.27
8	56.0	67.6	0.24	0.50	0.13	0.34
9	51.4	67.4	0.26	0.45	0.13	0.30
10	53.5	70.4	0.28	0.41	0.15	0.29
11	53.3	67.8	0.23	0.42	0.12	0.28
12	49.3	63.3	0.23	0.32	0.11	0.20
13	62.6	66.0	0.25	0.52	0.16	0.34
14	54.7	64.0	0.25	0.40	0.14	0.26
15	52.0	63.9	0.40	0.47	0.21	0.30
Average	53.1	66.2	0.27	0.44	0.14	0.29
Average normal non-pregnant women	65.7		0.31		0.20	

At the time of delivery, the maternal plasma volume per unit of whole blood is considerably higher (average—13.1 per cent) than that of the fetus, so that the whole blood fibrin values show a greater difference in favor of the former than do the previously given plasma values. The average maternal whole blood fibrin is 0.29 per cent while the fetal blood contains roughly only one-half as much fibrin.

In order to offset the differences in concentration of the two bloods, the percentage relationships of the albumin, globulin, and fibrin to the total proteins have been calculated and are given in Table VII.

TABLE VII

ALBUMIN, GLOBULIN, AND FIBRIN PERCENTAGES IN FETAL AND MATERNAL PLASMAS

CASE NO.	TOTAL PLASMA PROTEIN GM. PER 100 C.C.		ALBUMIN PER CENT		GLOBULIN PER CENT		FIBRIN PER CENT	
	Fetal	Maternal	Fetal	Maternal	Fetal	Maternal	Fetal	Maternal
1	6.37	7.43	65.9	56.1	29.2	35.3	4.9	8.6
2	5.60	6.70	59.8	61.2	35.5	33.4	4.6	5.4
3	5.67	7.22	52.4	51.8	43.9	42.9	3.7	5.3
4	6.42	7.27	55.8	55.2	38.8	38.1	5.4	6.7
5	6.97	7.02	58.7	56.5	37.3	38.7	4.0	4.7
6	6.26	7.13	59.3	55.3	36.6	37.4	4.1	7.3
7	6.11	6.60	60.7	60.0	34.5	34.7	4.8	5.3
8	5.40	7.01	61.5	50.8	34.1	42.1	4.4	7.1
9	6.75	7.30	60.7	58.6	35.4	35.2	3.8	6.2
10	5.56	7.52	61.9	52.7	33.1	41.9	5.0	5.4
11	6.03	6.45	58.2	57.5	38.0	36.0	3.8	6.5
12	6.12	6.91	62.1	59.3	34.1	36.0	3.8	4.6
13	6.34	7.66	59.5	53.4	36.6	39.8	3.9	6.8
14	6.61	7.98	60.1	56.5	36.2	38.5	3.8	5.0
15	6.66	7.62	59.6	59.4	34.4	34.4	6.0	6.1
Average	6.18	7.18	59.7	56.3	35.9	37.6	4.4	6.1
Average—normal nonpregnant women	7.42		59.6		36.2		4.2	

There are no really significant differences in the percentage composition of the two bloods except that the maternal fibrin is much higher relatively as well as absolutely. The fetal albumin averages 3.4 per cent higher than the maternal, while the maternal globulin is 1.7 per cent higher than the fetal. In general, although not invariably, these differences are reflected in the individual samples.

## DISCUSSION

From the analytical results presented above, it is evident that there is very little difference in the percentage composition of the total plasma proteins of mother and child as compared with each other or with normal nonpregnant women, except that in the parturient woman the fibrin is increased. It would seem that human beings under normal conditions maintain relative proportions between the various proteins which may be characteristic of the species. Howe<sup>24</sup> has collected considerable evidence to show that in different animals the proportions vary to a certain extent.

The fact that the usual percentage relationship is maintained even though the total plasma proteins are diminished during gestation and are still lower in the newborn would seem to indicate that the various proteins are formed individually, rather than from one another, as has been argued, and that some definite set of conditions is directly responsible for the fact that the fetal plasma is relatively protein-poor. We have no definite idea as to what these conditions are, but the variation in the proteins may perhaps be looked upon as a mech-

anism to equalize the osmotic pressures in the two bloods. Calcium, inorganic phosphorus, and the amino-acids have been shown to be constantly in higher concentrations in the fetal plasma, whereas the lipid phosphorus and the plasma proteins are, except for certain pigments, the only substances which are known to be constantly higher on the maternal side of the placental barrier. The first three substances undoubtedly have some influence upon osmotic pressure even though they are in low concentrations, whereas lipid phosphorus certainly has a negligible effect and the whole burden of equalization may rest upon the protein substances, which themselves are so slightly ionized at the hydrogen-ion concentration of the blood that a considerable excess must be present in the maternal plasma to neutralize the effects of the calcium, inorganic phosphorus, and amino-acids. It has been shown repeatedly that the depression of the freezing point is the same in the two plasmas,<sup>25, 26, 27, 28</sup> a fact which indicates that the maintenance of an equal osmotic pressure is normal, and probably essential to proper placental transmission.

The lower absolute and relative fibrin values in fetal blood correspond with its slower clotting time,<sup>29</sup> and perhaps also with its greatly prolonged sedimentation time,<sup>20, 22, 30</sup> if the association of increased fibrin and rapid sedimentation of the blood cells is looked upon as anything more than a coincidence. That fetal blood does clot more slowly is a common observation, as is also the high suspension-stability of the fetal cells. The latter phenomenon is, as far as we know, invariably associated with an increased fibrin and, according to Fåhræus,<sup>22</sup> with a definite agglutination of the cells, two things which may well be related. In this connection, it should also be noted that the fetal globulin is lower than the maternal, a fact which Linzenmeier<sup>30</sup> thinks is of importance in determining the sedimentation rate of the blood cells. Cholesterol is likewise lower in fetal plasma,<sup>31, 32, 33, 34, 35</sup> and this diminution may operate with the decreased globulin to promote the increased suspension-stability. (Löhr.<sup>20</sup>)

Englemann and Elpers<sup>36</sup> have shown that the viscosity of fetal blood is markedly greater than that of the maternal blood—5.8 to 3.7. The larger number of blood cells in the fetus<sup>37</sup> and their higher volume percentage (Table VI) probably account for this difference, since the diminution of plasma proteins, especially the fibrin and the globulin, should operate in the other direction. Alder<sup>4</sup> has compared the viscosity of fetal and maternal serum and has shown that the former is less viscous than the latter.

The lowered surface tension found by Alder<sup>4</sup> in fetal blood is undoubtedly related directly to the diminished quantity of protein in the fetal plasma.

## CONCLUSIONS

Fetal plasma is relatively protein-poor as compared with maternal plasma, all the protein fractions being maintained in higher concentrations in the latter.

In spite of these absolute differences, the relative proportions of serum-albumin and serum-globulin are maintained very nearly as in normal nonpregnant women. The fibrin, on the other hand, is both absolutely and relatively increased in the maternal plasma.

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## THE PREVENTIVE ASPECTS OF POSTPARTAL CARE\*

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**A**DVANCES in prenatal care have resulted within the last decade in so marked a decrease in mortality that even the most prophetic among us hesitates to say how far reaching will be the social and economic consequences of this salvage of human life. In properly conducted clinics the mortality among parturient women has also been markedly decreased, although to our shame it must be admitted that this is by no means the case outside of such clinics, and as a result the United States is still far down on the list of civilized nations in this regard. For some reason, however, scientific watchfulness seems to end with the delivery of the child, and I think most of us will agree that a large proportion of our gynecologic cases is still, as it always has been, drawn from those women who are the casualties, so to speak, of our own or someone else's obstetric practice.

Recent statistics of the British Government show that 1 in every 400 women confined at full term loses her life, and although the exact figures are not now available and probably never will be, it is not too much to say that for every woman who dies, 5 undergo a period of morbidity, sometimes temporary, but too often resulting in permanent disability and complete invalidism. The major obstetric tragedies are usually sufficiently striking to command our attention, but this is not true of the relatively minor mishaps, and for this reason I think it will not be unprofitable to consider tonight the care of the parturient woman, at least in certain aspects, from the standpoint of preventive medicine.

To a group of specialists it is hardly necessary to emphasize the fact that a systematic examination from six weeks to two months after delivery is quite as important as a systematic examination prior to delivery to determine the proportions of the pelvis and the relative size of the child, but unfortunately this gospel is not universally accepted by the men who are still handling the bulk of obstetric practice. Such an examination, even after a nonoperative, relatively simple labor, will frequently reveal a rather astonishing degree of cervical pathology. Tears of various types may be present, stellate or bilateral, superficial or extensive, and they may even extend into the parametrium or the broad ligament. It is not unusual to find a red, angry, succulent-looking cervix, which bleeds on the slightest manipulation and which is unquestionably pathologic.

In the light of our present knowledge of cervical disease we have no right to dismiss such findings as unimportant. I need not point out to

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you that such a condition may be the foundation not only of a chronic endocervicitis, with its various steps of cyst formation, fibrosis, and hypertrophy and its train of annoying symptoms, but also of an ascending lymphangitis which may terminate in a persistent parametritis or in adnexal pathology. You are aware, too, of the various systemic manifestations of disease which may arise from such a cervical condition.

The choice of treatment must of course be dictated by the circumstances of the individual case. Topical applications may be sufficient for the simple cases, but as a rule even they are better handled by the use of the small electrocautery, a perfectly feasible office procedure which gives eminently satisfactory results. In deep-seated infections cauterization under anesthesia may be necessary, and extensive tears obviously demand repair. I am aware that in some clinics it is still the custom to advise against trachelorrhaphy in women in the childbearing period because of the chance of repeated injury in subsequent pregnancies, but in my opinion this danger is more than overbalanced by the harmful possibilities inherent in a neglected, pathologic cervix.

When the postpartum examination reveals a prolapsed, retroflexed, flabby uterus, where involution has obviously been faulty, the pessary is frequently an effective remedy. Although this agent is today little used in gynecologic practice, its use is widespread among experienced obstetricians in this particular condition. The supporting ligaments of the uterus are soft and flabby during pregnancy, and the uterus itself, even after delivery, is considerably heavier than normal, so that the mechanism of displacements is easy to comprehend. With a properly adjusted Smith or Hodge pessary, however, the uterus may be held in position for two or three months, until it is of normal size and the ligaments have regained their normal tone, and by the timely use of this simple measure subsequent suspensory operations will be cut down at least 30 per cent. On the other hand such a condition, if neglected, may end in decidedly more serious pathology, particularly if it is associated with a relaxed or torn pelvic floor.

In some instances injury to the perineum following delivery is of such a superficial character that repair is not indicated; as a general rule, however, perineorrhaphy immediately after delivery is a wise plan. When this has not been done, repair may possibly not be indicated immediately providing the tear is not extensive, the uterus is well involuted and in good position, and the patient is fairly free from symptoms. Otherwise immediate repair should be advised. Postponement of the necessary surgery under these conditions can only result in a further relaxation of the pelvic floor, the development of cystocele and rectocele with their train of annoying pelvic and vesical symptoms, or even prolapse, for the correction of which decidedly more radical procedures are necessary.

Many of these conditions which we have been discussing are due to lax supervision of the patient's actual period of lying-in. In former

years it was the invariable rule that puerperal women should remain in bed two to four weeks, usually entirely recumbent; in recent years the pendulum has swung to the other extreme, and in some clinics today the patients are encouraged to leave their beds as soon as they feel inclined, no matter how short the time after delivery may be. If we must choose between the extremes, the longer lying-in period is the wiser plan, since one who understands the physiology of the puerperal state and realizes the size and lack of tone of the uterus, the laxity of the supporting ligaments, and the mechanics of intraabdominal pressure, will appreciate the dangers inherent in too early an assumption of the upright position.

Free movement, of course, is highly desirable from the beginning to facilitate drainage, and it is a wise plan to encourage patients within a few hours of delivery to move from side to side, and within a few days to sit up properly supported, but no patient should be allowed out of bed, no matter what day postpartum it may be, until the lochial discharge is practically serous in character and the uterus has retracted well below the symphysis. Even then free movement should be restricted and should be undertaken only gradually.

Another point to be considered in this regard is that enteroptosis, with its train of apparently intractable symptoms, is often acquired in the postpartal period, a consideration particularly worthy of comment in these days when the short abdominal corset or none at all is the rule. Proper support of the overstretched, thinned-out abdominal muscles is essential, and the wearing of an abdominal binder or a properly fitted corset should be rigorously enforced. Passive exercise should be advised during the actual stay in bed, and graded exercises, the knee-chest position, and the continuation of massage should be advised for several weeks postpartum.

Because of the trauma of labor, the lowered intraabdominal pressure consequent upon the tremendous reduction in size of the gravid uterus, and the generally bruised and sensitive condition of the pelvic structures, as well as actual lesions of the vesical mucosa, bladder complications are not infrequent during the puerperium. Overdistention, in fact, is so common after labor that too much stress cannot be laid upon the necessity for frequent and complete evacuations of the bladder. The patient should be encouraged to void within six hours after delivery, and regularly every six or eight hours thereafter. If this is difficult, simple assisting measures should be resorted to, such as warm irrigations, hot applications, possibly warm enemas, even the assumption of the sitting posture if the delivery has been nonoperative and the lacerations are of a minor character. If these measures fail, regular use of the catheter must be resorted to, so that the bladder may be emptied frequently and completely. The strictest asepsis, of course, is essential, and regular urinalyses should be made, so that a possible cystitis may

be recognized and treated at its inception, when the cure is a fairly simple matter. It is hard to say how many of the cases of obstinate trigonitis and cystitis which fall into our hands are due to disregard of this commonsense precaution, and it may be added that while upward extension of the infection is not usual, it is a real possibility, the occurrence of which should be prevented at any cost.

It should be emphasized also that regular urinalyses are important in the postpartal period in those patients who have shown a pyelitis during the prenatal period. The symptoms of this condition are usually readily amenable to the proper treatment and ordinarily disappear when the weight of the gravid uterus is removed, but the continuation of the infection is by no means uncommon, and urologists tell us that it is surprising how often in such cases *B. coli* will be demonstrated in one or both ureters, while an active bladder infection may persist for months afterwards. The proper diagnostic measures will reveal the condition so readily that in view of the grave permanent damage which may result there is little excuse for their neglect when the slightest indications for their employment are present.

Continued observation of the urine is obviously essential in women who have, during their pregnancy, given evidence of any sort of toxemia. Even with the aid of blood chemistry it is frequently not possible to differentiate between a pure nephritic and a preeclamptic toxemia. As a general rule it may be stated that the earlier in the pregnancy the symptoms of renal insufficiency appear, the more likely is the condition to be one of actual nephritis, but since the treatment of both conditions is substantially the same, the differential diagnosis at this stage is not a matter of great moment.

In the postpartal period, however, the situation is different. Eclampsia and preeclamptic toxemia rarely reappear in subsequent pregnancies, and women who have passed through one attack may usually conceive with impunity at a later date, since permanent renal damage is most unusual. On the other hand, a nephritic toxemia tends to reappear in an aggravated form and at an earlier period in each subsequent pregnancy, so that eventually childbearing may jeopardize life. In the puerperal stage the differential diagnosis is usually simple; as a working rule we may say that when casts, albumin, and other urinary abnormalities persist beyond a month or six weeks, the condition is a purely nephritic one, and the patient should be warned that further childbearing is both unwise and actually hazardous.

Most of the suggestions which I have made, you will note, involve merely the application of certain commonsense rules with whose theoretical application we already are in hearty accord, but whose practical employment we are sometimes inclined to overlook because they are so simple and obvious. I believe, however, that if in our daily practice we emphasized the importance of their routine employment, we would

not only lessen considerably the volume of gynecologic surgery which has its *raison d'être* in careless obstetrics, but would also eliminate to a large degree the period of invalidism which the average woman is too prone to consider an inevitable part of every confinement.

512 HIBERNIA BUILDING.

(For discussion see page 907.)

## CURETTAGE OF THE UTERUS, ITS INDICATIONS AND ADVANTAGES\*

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WITH the exception of case reports, most of them from foreign clinics, barely a dozen titles are listed under the general heading of curettage of the uterus during the last five years. The majority of these condemn the procedure very cordially, and many of them quote with approbation Emmet's dictum, enunciated shortly after Sims had modified and popularized the curette, to the effect that "the ingenuity of man had never devised an instrument capable of doing more injury." It is with considerable trepidation, therefore, that I venture to defend the operation of curettage, in the face of the eminent authorities who have united to condemn it. I am far from wishing to advocate the promiscuous use of this procedure, or to offer it as a panacea for all the gynecologic and most of the obstetric ills to which woman is heir, but I do believe that the tendency today is to belittle its usefulness and to narrow its limitations, while in its stead are performed quite complacently surgical procedures whose technic is more difficult and whose effects are more radical.

The day of curettage for any indication or none at all is happily past, and yet it is too often performed, even now, by men to whom it seems too simple to be dangerous, or who, as Bovée puts it, regard it as the first rung on the ladder which leads to being known as surgeons. It should be axiomatic that any surgical procedure, no matter how simple and trivial it may seem, carries with it the potentialities of a perfectly definite morbidity and mortality, and this is quite as true of curettage as it is of a laparotomy. Certain conditions are prerequisite, therefore, to its successful performance, the first of which is that the man who undertakes it, preferably a gynecologist, should have a comprehensive knowledge of the anatomy of the pelvis and of the pathology which he proposes to remedy. Also it should never be done until a full, carefully taken history has been interpreted in the light of a thorough bimanual examination, again by a man with the requisite knowledge of pelvic anatomy and pathology and with the requisite

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tactile sense to make out the conditions which are present. You cannot curette with a clear conscience until these things have been done.

It is essentially a hospital procedure, in spite of Dr. Kelly's advice to the specialist to do it in his office, and anesthesia, in most instances, is essential to its thorough performance, nitrous oxide or ethylene being the most satisfactory. Occasionally local anesthesia may be indicated in patients in whom organic lesions make full narcosis unwise, and occasionally also, in elderly women with open cervixes, a diagnostic curettage may be done without anesthesia, but as a rule the discomfort and actual pain are sufficiently great to make complete relaxation of the pelvic structures impossible without general anesthesia. Last of all, the strictest asepsis is necessary throughout, not only in the instruments and linen used, but also in the preparation of the patient, else the risk of infection being carried upward is considerable.

Our indications for curettage are rather wider than those ordinarily advanced. Polak, for instance, will admit only two, the removal of the products of conception before the eighth week, and the diagnosis of intermenstrual bleeding at or after the menopause. To my mind, however, if we limit ourselves to such narrow indications as these we shall lose many opportunities of relieving our patients by a relatively simple procedure, and we shall certainly, as I propose to show you later, perform a good deal of unnecessarily radical surgery.

The diagnostic indications for curettage are fairly well standardized, the first of them being intermenstrual bleeding or uterine discharge at any age, but particularly at or near the menopause. Uterine hemorrhage in young women may offer some justification for delay, but in view of the disastrous possibilities always inherent in this symptom, I can see no reason for delay in women of menopausal years. This is particularly true of fundal carcinoma, in which early hysterectomy gives probably a higher percentage of cures than we are able to achieve in any other form of pelvic malignancy. For this reason we do routine curettage as a preliminary to all plastic work, whether there are suspicious symptoms present or not. It takes but a few additional minutes and it adds practically nothing to the risk of the operation or the discomfort of convalescence, yet I can recall offhand more than one instance in which by this means unsuspected fundal malignancy was revealed and a life-saving hysterectomy done. Curettage is also done as a routine before irradiation, not only to eliminate possible malignancy but also to remove cervical and uterine polypi, for radium, as you know, should never be applied in the presence of such growths. This does not apply, of course, to irradiation done for cervical malignancy.

Turning to the therapeutic indications for curettage, we are at once upon debatable ground. Naturally there can be no question, in

the face of the work of Cullen and Curtis, that endometritis, per se, is a rare clinical entity, and that essential infection of the uterine mucosa is also extremely rare. The fact remains, however, that under certain conditions its removal, although both illogical and empirical, does seem to work either improvement or cure. In dysmenorrhea, for instance, curettage is usually advocated for the membranous type and condemned for all other types. In the few instances of true membranous dysmenorrhea which I have seen, curettage, no matter how often repeated, has done only slight, temporary good, while simple dysmenorrhea, particularly when associated with the so-called polypoid endometritis, has usually been either temporarily or permanently relieved by this measure. I would point out, however, that, particularly in young girls, it should be a last resort and done only when systemic and organic conditions have been eliminated and general dietetic and hygienic measures have been given a thorough trial.

Curettage for sterility is equally irrational and illogical, but here too its empirical performance, particularly if associated with the use of a stem, will result in conception in a small percentage of cases, possibly 15 or 20 per cent, and this is quite as true of the so-called relative or one-child sterility, provided it is not of infectious origin, as of the absolute type. It seems hardly necessary here to reiterate that such a procedure should never be contemplated until the husband has been eliminated as a factor in the trouble. It may be that the dilatation of the cervix rather than the curettage is responsible for the occasional good result, though most authorities, I believe, incline to the opinion that a cervical canal which permits the exit of the menstrual flow will present no insuperable barrier to the ingress of the spermatozoa.

Menorrhagia is not, as a rule, an indication for curettage, since it is usually the symptom of some other condition, adnexal disease, fibroid growths, glandular derangements, even systemic diseases, which are obviously not amenable to local treatment, but here again in rare instances curettage, sometimes repeated as indicated, will afford temporary relief. I have in mind one special case in which curettage at intervals throughout her menstrual life held in check an intractable menorrhagia, often associated with metrorrhagia, and probably of ovarian origin, in a patient who otherwise would have had to submit to a premature menopause from irradiation or hysterectomy many years before. When it no longer checked the bleeding, she was sufficiently near the menopause to warrant the use of both radium and x-ray without annoying menopausal symptoms. Hemorrhage due to persistent subinvolution, which uterine tonics, local treatment and douches, as well as the correction of retrodisplacements, have failed to relieve, is usually ended at once by curettage. In practically every

instance this condition is due to the persistent retention of decidual remnants, and their mechanical removal ends the bleeding.

Hemorrhage due to incomplete abortion, where an open cervix indicates that decidual products and secundines are retained, may demand curettage if the simpler measures of packs, ergot and pituitrin have failed. After the eighth week, however, the débris is better removed with the finger or the sponge forceps. In the presence of infection, whether postabortal or postpartal, curettage should never be done. As DeLee says, it is like raking over a ground freshly sown with seed. In many such infections the process is already systemic, so that local treatment is of no avail, and if it is local, the necrotic process is purely a surface one, and even the gentlest manipulation may break down the protective zone of leucocytic infiltration just beneath it and thus convert a simple local process into a true blood stream septicemia.

Leucorrhea, so often advocated as an indication for curettage, should never be so considered. Its source is extrauterine, usually the cervix or the tubes, and obviously the curette cannot reach them, while its use may possibly convert an extrauterine infection into an intra-uterine or even a systemic process. One exception to this rule is in the case of uterine hyperplasias associated with chronically infected cervixes, particularly where cystic degeneration of the glands has begun; in these instances the two conditions should be corrected simultaneously. As a general rule, however, we may say that any sort of infection of the genital tract, latent, chronic or acute, contraindicates curettage, particularly if fever is also present. There may conceivably be conditions in which curettage is indicated, even under these circumstances, but the surgeon who advocates it should do so with a full realization of the added risk he is assuming.

As I have already emphasized, this is not a procedure for the general practitioner; even in the hands of a specialist it is not devoid of danger. There is always, for instance, the possibility of the flare-up of an unsuspected infection, of cervical, tubal or intestinal origin, which even the most scrupulously careful history and examination will not reveal. I recall particularly one instance in which curettage was done for a mild grade of membranous dysmenorrhea, associated with menorrhagia. History and examination revealed not the slightest trace of infection, yet two days later chills and high temperature developed with marked pelvic pain; at the end of ten days a localized pelvic abscess was opened under anesthesia, and a tedious convalescence of many weeks followed. In a second instance curettage was done for an annoying, definitely uterine discharge, the result of an old pelvic inflammation for which salpingectomy had been done many years before. The patient developed both peritonitis and septicemia, together with a retroperitoneal abscess and necrosis of the psoas muscles, and death ensued shortly. I cite these two instances to



point out that even when done for studied indications, by a specialist, the operation sometimes culminates in disaster.

The dangers of the actual operation are almost too well known to need rehearsal. They include rupture of the cervix, from too rapid and too forceful dilatation, particularly with the glove-stretcher type of instrument, whose degree of force is extremely difficult to gauge; puncture of the uterus by the sound, in endeavoring to ascertain its depth and direction, an accident peculiarly likely to occur after abortion, when the uterine wall is thick and vascular, and injury to the intestines, when puncture has occurred, by trauma from the sound, sponge, forceps or curette. In addition there is sometimes the danger of interrupting an unsuspected pregnancy, when no period has been missed or when the patient has willfully given a misleading history.

The advantages of the operation, however, to my mind definitely outweigh its disadvantages and dangers, most of which can be eliminated or at least guarded against if sufficient care is exercised. The procedure, if done by a specialist in pelvic work, is usually a simple and safe one. The period of hospitalization is short, seldom more than three days, so that the inconvenience and expense to the patient is almost minimal. As I have pointed out, curettage is a valuable diagnostic aid, and its routine performance before plastic operations and irradiation not infrequently reveals unsuspected malignant disease and permits the institution of early treatment.

It is frequently curative in dysmenorrhea and occasionally curative in sterility, and in dysmenorrhea, even if it does not cure, it is usually of temporary benefit. In this connection I might quote Dr. Howard Kelly, who, with his usual ripe wisdom, points out that even if the cure is irrational and illogical we should not quarrel with it, since what our patients are after are cures, with or without sound theories behind them. Moreover, temporary relief in dysmenorrhea is usually very gratefully received by the sufferer. More than one patient has told me that the months of relief which were thus afforded her have enabled her to get her physical and nervous balance, so that when the dysmenorrhea recurred—and the recurrence is usually of a less severe type—its effects were by no means so trying. I have not attempted a statistical study in this matter, but I might say that every point I have made could be substantiated by large series of cases.

Possibly most important of all, curettage frequently avoids for the patient a radical and lethal operation. A recent investigation of 222 hysterectomies at Touro Infirmary by Dr. C. Jeff Miller over a three-year period proved this point very conclusively. Nine uteri were reported by the laboratory as entirely negative, and 19 others showed only metritis, fibrosis, or hyperplasia; in addition, there were 3 unsuspected pregnancies and 2 incomplete abortions. On the face of the records, therefore, the simpler measure of curettage would have elim-

inated 33 major operations in this particular series. An even more striking instance recently came to my knowledge, wherein hysterectomy was done for supposed fundal carcinoma in an elderly woman, who succumbed to shock shortly after the conclusion of the operation. The laboratory reported the uterus entirely negative for neoplasm. A preliminary curettage would probably have saved that life.

I have, as I have said, no intention of advocating curettage upon promiscuous indications, or of singing its praises as a gynecologic cure-all. I do believe, however, that it deserves more consideration than is at present accorded it, for the reason that it is a valuable diagnostic aid, that in selected conditions it is palliative and even curative, that it involves as little morbidity, inconvenience and expense as any possible hospital procedure, and that its routine performance as a preliminary to major surgery of the pelvis will render much of that surgery entirely unnecessary.

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## THE VALUE OF GLUCOSE AND INSULIN TO THE OBSTETRICIAN AND GYNECOLOGIST\*

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WHEN in 1921 the years of earnest endeavor to isolate the anti-diabetic hormone of the pancreas culminated in the successful animal experiments of Banting and Best, and a few months later in its brilliant clinical results in human diabetes, it was not realized that there had been discovered an agent which would exert not only a palliative effect in that particular affection, but also an apparently curative effect in other widely different conditions. Within the last two years, however, due largely to the work of Thalhimer, the addition of insulin to the already successful glucose treatment in certain toxic manifestations of pregnancy has resulted in markedly better results than have ever been achieved by any other type of therapy.

The underlying factor in the pathology recognized as diabetes is an abnormality of the carbohydrate metabolism, and the palliative effect of insulin in this condition lies in its power to promote the combustion of carbohydrates. This being the case, it was almost natural that the use of insulin should have been gradually extended to other conditions in which, although the pathology was not clearly understood, it was realized that the carbohydrate factor was at fault. Glucose, as we have said, had already given good results in certain of the toxemias of pregnancy, and the logical reasoning was that, since its administration alone gave good results, certainly the additional administration of insulin, with the consequent increased rapidity of the utilization of the glucose, would bring to pass these desired results even more rapidly.

Thalhimer's work on postoperative acidosis accompanied by vomiting led him to subsequent studies upon the so-called pernicious or toxic vomiting of pregnancy, the basic idea being that the acidosis which is so prominent a factor in the last stages of this type of vomiting is not only a result of the stomach's intolerance of food, but also a factor in producing that intolerance. It follows, then, that if the resulting vicious circle can be broken through, either by abortion, which checks the vomiting from the standpoint of the toxin of pregnancy which has produced it, or by the correction of the acidosis, which the administration of glucose and insulin does admirably, the pathology will either be considerably curtailed or actually eliminated.

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It might be added that if the vomiting is not checked, a starvation acidosis will result whether the original vomiting was of the toxic or the neurotic type.

To date we have used glucose and insulin in six cases of vomiting of pregnancy, all them definitely of the toxic type, as proved by the low blood sugar and the low  $\text{CO}_2$ -combining power of the blood, as well as by acetone in the urine of four cases. In no instance was abortion necessary; four of the patients have subsequently been delivered at term, and in the other two cases the pregnancy was progressing normally when the patients were last seen. In two instances the recovery was dramatic in its rapidity, and one of these cases is herewith appended:

Mrs. G. was admitted to the hospital when four months' pregnant. She had been vomiting for six weeks and was completely dehydrated; she was retaining nothing and was vomiting blood. Pulse 118, temperature  $101^\circ \text{F}$ . Urinalysis showed both acetone and diacetic acid, and the blood sugar and the  $\text{CO}_2$ -combining power of the blood were far below normal limits. Treatment before admission had included the usual measures of peptonized food, hypodermoclysis, proctoclysis, gastric lavage, etc., without the slightest alleviation of the condition, and their repetition within the hospital was also without result. After glucose and insulin had been administered twice the vomiting ceased abruptly, food was given without restriction, and the remainder of the pregnancy was without incident. This is the type of case which under the old methods of treatment would inevitably have demanded therapeutic abortion, perhaps with a fatal outcome, as the patient's condition was most critical when she was first seen. I might add as an irrelevant but rather interesting fact that when the child was eighteen months old he developed a severe acidosis, which was treated by Dr. L. R. DeBuys of the Pediatric Service by glucose and insulin, with immediate good results.

We have used this form of therapy with excellent results in eclampsia and preeclamptic toxemia. The etiology of these conditions is as yet entirely obscure, but as a result of personal research work, recently published in *Surgery, Gynecology and Obstetrics*, I believe I have clearly demonstrated that either an acidosis or a tendency to acidosis exists in both of these conditions. To review the work briefly, in a study of fifty such cases I have uniformly found that the blood sugar is materially reduced, as is the  $\text{CO}_2$ -combining power of the blood, and that there is practically no change in its nitrogenous constituents, while in advanced cases both acetone and diacetic acid are demonstrated in the urine. In our clinic it is a routine practice to differentiate these cases from the purely renal conditions by detailed investigations into the diastatic activity of the urine, the relative amounts of serum albumin and serum globulin, casts, blood chemistry, and kidney function by the phenolsulphonephthalein test. In none of the purely nephritic cases did we find either the blood sugar or the  $\text{CO}_2$ -combining power of the blood lowered.

Mann in his experimental work on dogs proved quite definitely that following hepatectomy a definite decrease in blood-sugar results, with

a consequent decrease of the glycogen content of the muscles, and subsequent convulsions and coma. The parallel with eclampsia is quite clear. Large series of autopsies have shown that in that affection there is a destruction of the liver which for all practical purposes is the equivalent of its entire or its partial surgical removal; Krebs and Dieckmann have shown that there is a definite impairment of the liver function as a result of this destruction, their work being based on the Rosenthal test; and the classical symptoms of eclampsia, convulsions and coma, are only too well known to those of us who are practicing obstetricians. In any destruction of the liver, therefore, whether by surgical removal or as the result of disease, the carbohydrate metabolism and the storage of glycogen are seriously impaired, the blood sugar and  $\text{CO}_2$ -combining power of the blood are lowered, and either acidosis or a tendency to acidosis results, with the actual occurrence of acetone and diacetic acid in the urine, due to the imperfect combustion of fats in the absence of the necessary glucose.

In some fifteen cases we have demonstrated to our own satisfaction that the addition of insulin to glucose in the treatment of eclampsia and preeclamptic toxemia is a tremendous advance over any previous treatment. In our clinic conservative treatment is the routine in eclampsia. We employ either the Stroganoff or the Dublin Rotunda method, combined with venesection in the face of a rising or persistently high blood pressure, and the administration of glucose and insulin. In every case in which we have employed this treatment the blood sugar and the  $\text{CO}_2$ -combining power of the blood have risen; the diastatic activity of the urine, which is always high, has approached normal figures; convulsions have ceased, and the patient's general condition has been markedly improved.

In the employment of glucose and insulin it is most important to differentiate between a true preeclamptic or eclamptic toxemia and a purely renal condition. If we are dealing with a kidney condition alone, glucose and insulin are valueless, since their effect is directed entirely towards staying the destructive processes of the liver and restoring the carbohydrate balance. Eclampsia, however, may give rise to a recent secondary nephritis, with partial or entire suppression of urine, and in two such instances in this series I employed a 20 per cent glucose solution (twice the percentage ordinarily used), in the hope that the usual amount of insulin would utilize sufficient of the glucose to restore the carbohydrate balance, while the remainder of the glucose would act upon the kidneys as a diuretic. In both instances the patients recovered, but whether their recovery was a consequence of this theoretic treatment I am unable to say. It might also be added that if the facts which I have stated are correct, our present habit of restricting the diet of patients in true eclamptic toxemia is radically wrong, and the only restriction should be in the use of fats.

We have also used glucose and insulin with marked success in the acidosis which follows hemorrhage. Our first case of this type, which occurred over a year ago, was reported by the author and Dr. Henry Macheen in the *New Orleans Medical and Surgical Journal*, and is briefly appended hereto. Since then I have personally handled two more such cases, and have seen a fourth successfully handled by another man on our division.

The theory is briefly this: the clinical evidences of shock include complete muscular relaxation or feeble and irregular movements; pallor; dilated pupils; semiconsciousness or diminished sensibility and mental activity; feeble respirations; small, frequent, and dierotic pulse; subnormal temperature; vomiting; low blood pressure, and acetone in the urine. Practically all of these criteria, I might say, were present in each of the cases under discussion. The work of Cannon has proved that although acidosis is not necessarily present in conditions clinically diagnosed as shock, in the majority of instances it does exist and it may be extreme. Moreover, in no condition is rapidity of treatment more essential, which furnishes, to my mind, a cogent reason for including insulin in the already established glucose therapy. Whether the excellent results are due to the entire consumption of glucose administered (as is shown by the absence of sugar and acetone in the urine shortly afterwards), or to the fact that the body is enabled to hold fluids which otherwise would have been excreted by the kidneys subsequent to their stimulation by free glucose, we cannot say, but the brilliant recoveries of the patient speak for themselves.

CASE 1 (previously reported by the author and Dr. Henry Macheen).—The patient was admitted after profuse hemorrhage lasting for several days, following a criminal abortion. All the classical signs of shock were present, including a pulse of 140, temperature 97.6° F. and blood pressure 75 systolic. Vaginal packing and pituitrin by hypodermic injection were followed shortly by a transfusion of 250 c.c. of citrated blood. Vomiting began within three hours and continued almost without cessation for twelve hours. Meantime the condition of shock increased in spite of every measure to combat it, the blood pressure fell to 70 systolic, and death seemed imminent. At this time a catheterized specimen of urine showed an acid reaction and quantities of acetone. On this indication intravenous glucose was given at once with insulin, and the same procedure was repeated within two hours. The relief of the vomiting was almost instantaneous, the urine was acetone-free within six hours, and further recovery was uneventful.

CASE 2.—This patient had a manual removal of a retained placenta after persistent hemorrhage. Shock ensued, with a systolic pressure of 80; nausea and vomiting within a period of ten hours, and acetone in the urine. Glucose and insulin gave immediate results.

CASE 3.—This patient was admitted with profuse hemorrhage following a spontaneous incomplete abortion. Her blood pressure was 82 systolic, there was acetone in the urine, and she was nauseated, although she had not begun to vomit. Glucose and insulin were given at once as a prophylactic measure, and the condition cleared up without further symptoms.

CASE 4 (reported by the courtesy of Dr. Arthur Caire, Jr.).—This patient presented the typical symptoms of shock after a postpartal hemorrhage, including nausea, vomiting, and acetone in the urine. The response to glucose and insulin was immediate.

A fourth use for this type of therapy has recently occurred to me, and although I have had no opportunity of trying it out, I am including it here as a matter of record. Dr. John O. Polak, who is an ardent advocate of small, repeated blood transfusions (200 to 300 c.c.) in any sort of gynecologic or obstetric sepsis, recently told me that since he has learned that Rabinowitz, of Montreal, has demonstrated that an acidosis exists in all such cases, he has been giving his patients, in addition to the whole blood, an equal amount of slightly alkalized Ringer's solution. Theoretically this is correct, but the work of Mann upon hepatectomized dogs, to which I have already referred, has shown that the metallic alkalis have no effect in retarding inevitable rapid death under these conditions. Since glucose and insulin, however, have the desired effect, would it not be logical to employ them in the acidosis of sepsis? Theoretically there could be no objection, and it will be interesting to note the clinical results when an opportunity is offered of trying out the treatment.

The technic of the administration of glucose and insulin is important. In our clinic we use a modification of Thalhimer's technic, giving from 500 to 1,000 c.c. of 10 per cent glucose, according to the indications, gauging the insulin so that 1 unit is given for each 3 grams of glucose, administering one-third of the amount of each until the entire quantity has been given, and giving the solution as slowly as in the Matas intravenous drip. The glucose is always given intravenously, since experience has shown that uniformity of result cannot be achieved by any other mode of administration, and the insulin, of course, is given by hypodermic. The strictest asepsis should be observed, and special care must be taken that the glucose is chemically pure and that none is held in suspension.

In conclusion, it should be emphasized that this is not a form of therapy to be given on haphazard indications. Unfortunately, in dealing with the toxemias of pregnancy we are dealing with conditions whose etiology is unknown, and any form of treatment is necessarily empiric and directed only towards the relief of symptoms, but at least we can be as scientific as possible under the circumstances. In particular, careful laboratory determinations are essential, and accurate estimation of the dosage is based on the results of these findings. In this connection I might say that I consider such pronouncements as the recent one of Stander and Duncan capable of doing incalculable harm. I disagree with them about the blood-sugar content in eclampsia—their findings of an increased blood-sugar content are directly contrary to mine of a consistently lowered one—but, aside from that, their advice to use

insulin without the necessary quota of glucose to my mind sets a most dangerous precedent. Until we are more certain of our course, caution must be the watchword, or a very valuable addition to our obstetric armamentarium will certainly be discredited.

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PHYSICIANS' AND SURGEONS' BUILDING.

(For discussion see page 907.)

## INTRACRANIAL HEMORRHAGE OF THE NEWBORN\*

BY JOHN F. DICKS, M.D., NEW ORLEANS, LA.

TWO distinct causes must be considered in any study of intracranial hemorrhage of the newborn, mechanical and traumatic factors, and hemorrhagic diathesis or hemorrhagic disease of the newborn, upon which certain investigators have laid much stress as a causative factor of intracranial hemorrhage. In a report made by Warwick in 1921, covering two hundred autopsies on newborn infants, 40 per cent of the cases showed evidence of intracranial hemorrhage, two-fifths of which, in her opinion, were caused by hemorrhagic disease. Rodda, who has done a great deal of original investigation upon the coagulation time of infants, states that 25 per cent of all newborn babies with cerebral hemorrhage show evidence of hemorrhage in other organs of the body also. Aside from experimental and laboratory work, there is much clinical evidence to support the theory of hemorrhagic disease. Rosamond, for instance, reports a case of intracranial hemorrhage following cesarean section, and numerous cases are on record of such a condition following normal delivery.

With all due respect to the important studies which have been made along these lines, I believe that too much importance has been attached to the hemorrhagic disease theory, and that we as obstetricians are rather too inclined to use it as a cloak to cover our obstetric errors. Trauma, to my mind, is the most important factor in intracranial hemorrhage of the newborn, although it must be admitted that in a fair percentage of cases this trauma is beyond the control of the obstetrician. It is the sudden or excessive compression of the head which most often

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does the damage, as in a precipitate delivery; the slow pressure on the cranial bones during their passage through the birth canal plays small part.

It is now generally believed that breech deliveries are responsible for more cases of intracranial hemorrhage than any other complication of labor. It was formerly believed that asphyxia caused by pressure on the cord of the after-coming head was responsible for most of these deaths, but large series of autopsies have proved that intracranial hemorrhage is most often the cause. Brown, basing his observations on four hundred autopsies, concludes that intracranial hemorrhage is ten times more likely to occur in premature labor than in labor at term, and statistics in general go to prove that the most deadly combination for cerebral hemorrhage is the premature breech delivery.

The condition is important enough and frequent enough to warrant our careful attention. In large maternities it is now generally admitted that fully one-half of the stillbirths and the deaths during the first week of life are due to the cerebral hemorrhage, and investigations of orthopedists and pediatricians clearly show that a considerable percentage of the paraplegias of late childhood may be traced directly to the hemorrhagic brain at birth. Little in 1861 first emphasized the importance of these lesions in later life, but the direct connection between cerebral hemorrhage and the so-called Little's disease was first demonstrated by Sarah McNutt in 1885 in a series of ten autopsies.

Beneke in 1910 described the pathology and frequency of tentorial lacerations and since that time most authors have agreed with him that intracranial hemorrhages of clinical importance are most often situated above or below the tentorium cerebelli. Eardley Holland's exhaustive report to the Ministry of Health in 1922 bears out this theory and I take the liberty of quoting him freely in the following paragraphs.

His investigation shows that out of 167 fetuses dying during the course of labor the tentorium was found torn in 81 cases (48 per cent), with associated tearing of the falx cerebri in five cases and with subdural hemorrhage in all but six. In most cases the injury followed a breech or a forceps delivery, but in a few instances the labor was apparently entirely normal.

Holland has also explained the mechanism of these tears in a most satisfactory manner. Normally, he claims, the septa are in a state of rest, and nowhere in a state of positive tension. When the head undergoes changes of shape, alterations in the tension of the septa are inevitable, owing to the nature of their attachment to the cranial bones. He illustrates their behavior by the following experiment:

The scalp is reflected from a fetal head, and sufficient of one parietal bone removed to allow the corresponding cerebral hemisphere to be removed and the septa to be viewed. The head is compressed in the occipitofrontal diameter, so that it is shortened anteroposteriorly by the for-

ward displacement of the occipital bone, and heightened by the elevation and bending of the vault. The middle two-thirds and the inferior free edge of the falx cerebri and the tentorium cerebelli will seem to become stretched and tense. If the compression be continued the tension will increase, and finally the tentorium will become overstretched and tear near its free border, just below its junction with the falx.

Apart from the effects of tearing and hemorrhage, we must also consider the general rise of intracranial pressure. Just what part it plays in causing death we do not as yet know, but it is evident that the crowding down of the medulla oblongata into the foramen magnum must result in dangerous pressure on the so-called vital center.

In my experience the order of symptoms in intracranial hemorrhage is almost pathognomonic. For the first twenty-four to thirty-six hours after birth little unusual is noted, except that the child is apathetic and not inclined to nurse, and the cry is feeble. These symptoms may be combined with difficulty of resuscitation, and there may be also an unusual pallor, or intermittent cyanosis. The pulse is usually slower than normal, but strong and full. In about forty-eight hours after birth, however, the temperature suddenly rises to  $104^{\circ}$  or over, the respiration becomes rapid and superficial, convulsions and opisthotonos follow, and the classic picture is complete.

I append the following case reports as typical illustrative instances of the condition:

CASE 1.—K. W., born June 12, 1924. The history of the labor is important, as the mother was an elderly primipara, and the first stage was unusually tedious. Complete dilatation occurred after fifteen hours of pains at three or four minute intervals, and the head was well engaged, but no apparent progress was made, in spite of a small dose of pituitrin. After several hours of rest induced by morphia the pains were still ineffective, and I finally applied forceps, delivering a 7 pounds, 15 ounces female child without difficulty. The child did not cry spontaneously, but was easily resuscitated. It was noted at birth that the anterior fontanelle was extremely small, and that the child showed a disinclination to nurse, but aside from a slight cyanosis there was no sign of abnormality for the first forty-eight hours. Then the temperature rose sharply to  $104^{\circ}$ , she refused the breast absolutely, and clonic convulsions shortly ensued at irregular intervals. Drs. Bloom and Delahoussaye of the Pediatric Service were immediately called into consultation and assumed charge of the case. A spinal puncture was done, bloody fluid being obtained under pressure, and 20 c.c. of whole blood was taken from the father and given subcutaneously. The convulsions were controlled almost at once and the child's general condition seemed better. Repetition of the treatment twenty-four hours later resulted in marked improvement, and except for a few slight convulsions on the morning of the third day there were no further symptoms. I might add that at the second spinal puncture the fluid was clearer and under less pressure. The child today is apparently normal in every respect.

CASE 2.—J. W., born February 8, 1926. This case well illustrates the type of delivery in which intracranial hemorrhage so often occurs. The mother was a multipara, aged twenty-six, there was a face presentation, and complete dilatation occurred after fifteen minutes of hard labor. The condition was recognized immediately, anesthesia administered to the surgical degree, a deep episiotomy done at once, and

the face lifted over the perineum. At the time of delivery the face was almost black from pressure due to rapid descent in the extended position, and the child was resuscitated only after considerable difficulty. He was a male, weighing 7 pounds, and there was no external evidence of injury, although even after regular respiration was established the cry was feeble and of a moaning character. Dr. C. J. Bloom was called into the case immediately after delivery, although, aside from vomiting after each feeding, there were no alarming symptoms for the first forty-eight hours. Then the temperature went to 105°, the breast was refused, opisthotonos developed, and the vomiting was continuous. Spinal puncture was done at once, and 30 c.c. of bloody fluid was removed; a second puncture was done in twenty-four hours and 25 c.c. of bloody fluid removed. Hypodermoclysis of 5 per cent glucose was also administered. On the fourth day there was marked cyanosis, continued vomiting, labored respiration, rigidity, moaning cries, and intermittent clonic convulsions. The temperature was almost 107° and death seemed imminent. Hypodermoclysis was repeated at intervals, and twenty-four hours later there was considerable improvement, the temperature being lowered to 103°. From that time on there was a slow but constant improvement, and when the child was discharged, on the fifteenth day, there were no untoward symptoms. At present he weighs 11½ pounds, and except for sluggish pupillary reflexes seems entirely normal, although it is too soon to prophesy what the ultimate outcome will be.

#### CONCLUSIONS

The following conclusions, based upon the experience of others as well as upon my own, seem warranted:

1. Close cooperation is indicated between the obstetrician and the pediatrician on every maternity service, particularly following abnormal deliveries or in the presence of the slightest untoward symptom exhibited by a newborn infant.

2. If the obstetrician assumes the responsibility for the care of the child, he should examine it routinely every day for the first few days, and institute prophylactic treatment on the slightest indication of trouble.

3. Intracranial hemorrhage is the most frequent cause of cyanosis in the newborn, and should always be suspected whether the cyanosis is constant or fleeting.

4. Lumbar puncture should be employed frequently as a diagnostic aid, and not as a last resort in the presence of unmistakable symptoms.

5. In this day of preventive medicine the newborn infant has a right to expect the closest attention during its first week of life, and only by such attention can immediate and eventual catastrophes be avoided.

6. Trauma is the most constant cause of intracranial hemorrhage, and it should be emphasized that while it is sometimes unavoidable, it is very often the result of poor obstetrics.

## THE VOORHEES BAG IN THE INDUCTION OF LABOR, A CRITICISM

BY ALFRED L. MADDEN, M.D., ALBANY, N. Y.

THE cause of the onset of labor is unknown. As a result, the use of any device for instituting labor rests entirely upon experience. Physiologically the operative methods employed for this purpose depend upon the response of muscle to mechanical stimuli. The more important devices used are: the bag, the bougie, the rectal tube, and the gauze pack. Regarding the last three: The bougie stimulates a narrow zone from fundus to external os, but its action is well defined only as the spontaneous onset of labor is at hand. The rectal tube stimulates cervix and lower uterine segment, but not to equal degree in all points of their circumferences, since it is impossible to apply it accurately. The gauze pack stimulates cervix and, through vaginal vault, the lower uterine segment but, being soft and compressible, the resulting action is too often mild and insufficient. Considered from the viewpoint of degree of activity aroused, the bag best adapts itself to the end desired.

The Voorhees bag is a rubberized cloth bag, of conical shape, flat base, having at its apex a long filling tube. In manufacture it is rendered inelastic. Various sizes, suitable for cervixes of greater or lesser patency, are available. The important features of the bag are its rigidity and its shape, which, as viewed from the side, is that of a mechanical wedge. While the bag avoids the limitations of other devices, it has definite shortcomings peculiar to itself.

The primary use of the bag is that of a means of inducing labor, either before, at, or after term. It is also used to efface cervix as a preliminary to manual dilatation, and it is of inestimable value for lessening the hemorrhage of placenta previa, and for the retention, after replacement, of the prolapsed umbilical cord. Its occasional use as a means of dilating the vagina and perineum is incidental.

Simplicity of use renders the bag readily available to all, whether aware of its peculiarities or not. The method of introduction demands merely a knowledge of asepsis. Introduction is accomplished either by touch or by sight, the latter permitting a more secure technic and being the more satisfactory. After sterilization by prolonged immersion in strong bichloride solution or by actual boiling, the bag is rolled into the smallest possible mass, usually along an oblique line from base to side, and then passed directly into the cavity of the uterus; filling with sterile water or a weak antiseptic solution unfurls and distends it, the apex being guided into the cervix by

the filling tube. Degree of distention varies slightly according to the operator's choice; as a general rule it is carried to the uttermost limit, exception occurring in conditions of extreme cervical friability, as met with in placenta previa. The onset of contractions may occur immediately, but more often is postponed for from two to eight hours. At onset contractions are stronger and of greater frequency and duration than at the onset of spontaneous labor, and the degree of subjective pain is correspondingly increased. It must be noted that the position of the bag in the uterus varies both with the size of bag employed and with the degree of cervical dilatation at the time of insertion; it also varies from hour to hour as cervix dilates and the bag is gradually extruded. Descent of the filling tube gives a probable index as to advance of the bag through the cervix.

Intrauterine tension is increased by the introduction of the bag. The presenting part is elevated, disengaged in whole or in part, and removed from intimate relation to the cervix and lower segment. This upward crowding of the fetus may serve as a factor for stimulation of the upper uterine segment and must accompany an increase in the tension of both the uterine and amniotic cavities. A more important alteration occurring on bag introduction is the direct mechanical irritation of the cervix and the lower segment, greatest at the internal os, since the direct support of the bag is had there. Stimulation of the lower segment follows contact with rim and sides of the bag, especially after adaptation to the shape of the bag by the forces of labor.

Statistics covering labors induced by means of the Voorhees' bag require interpretation. In general, they may be summarized by the statement that 30 to 40 per cent terminate spontaneously and 60 to 70 per cent operatively. Variations in percentages directly follow variations in the indications for the induction of labor. As the field is widened to include more cases at or near term, involving a greater number of nearly or fully prepared cervixes, the percentage of spontaneous deliveries increases. In the majority of operative terminations the indication for interference is neither one of inertia, nor one of disproportion, but it is the indication of a failure of progressive cervical dilatation, occasionally during, but more often after, removal of the bag. It is an indication of replacement of the normal passivity of the lower uterine segment by tonicidity, and it implies the presence of contraction ring dystocia or of retraction of the lower uterine segment.

The ideal result would occur when bag introduction was followed successively by onset of labor, expulsion of bag, and uneventful progress of labor to complete dilatation of cervix and birth of the child. Such a result is the exception rather than the rule. The exception is determined by the characteristics of the individual cervix subjected to

this device. That cervix which is, to all practical purposes, fully prepared for the spontaneous onset of labor, as evidenced by shortening, softening, obliteration of the internal os and dilatation of the external os to one, one and one-half or more fingerbreadths will, upon bag introduction, take up and carry through the stages of labor quickly and uneventfully. On the other hand, that cervix which is unprepared for labor through preservation of length, firm consistency, uneffaced internal os and undilated external os, will react to bag introduction with tumultuous and obstructed labor. The painless contractions of pregnancy have as their primary function the development of the lower uterine segment and the effacement of the internal os. The first requirement for normal labor is the existence of these changes. The introduction of a bag before the existence of these changes cannot be expected to result in an even quasi-normal labor, and for such one must not hope. The term "rigid cervix" cloaked many cases of the type referred to, and prevented correct diagnosis. The reason for failure lies in an excessive irritation of the lower segment at a time when it is insufficiently differentiated from the upper segment to have entirely abandoned the rôle of contractility, and when the period of time required for extrusion of the bag, with removal of the irritating factor, is long by reason of the extent of work required. The resultant is a prolonged stimulation of a large area of contractile tissue by a tense, inelastic foreign body. That summation of stimuli produces tonicidity is to be expected, and for the removal of this tonicidity either inertia, resulting from prolonged labor, or deep surgical anesthesia is necessary. The normal mechanism of cervical dilatation is blocked at the junction of the upper and the lower uterine segments. Individual contractions thin and draw up the cervix and lower segment by elongation and withdrawal of their constituent fibers. Tone, or spasm, in the lower segment abolishes these processes; labor continues, but dilatation does not advance. The increased intrauterine tension may produce a purely mechanical, downward, pressure enlargement of cervix sufficient to expel the bag, and acting solely through shape and rigidity of the bag; but this succeeding, all else fails. The experiment with narcotics, or with degrees of anesthesia less than sufficient to produce complete muscular relaxation, is useless; that which does not relax skeletal muscle has still less effect upon tonic uterine muscle. The difficulty is not as great with retraction of the lower segment as it is with contraction ring dystocia, but this lesser degree is insufficient to remove the need for deep, continued anesthesia.

One can only admit that structures normally intermittently stimulated by the soft, elastic "bag of waters," can hardly be expected to respond in a like manner to stimulation by a tense, rigid device, constantly applied and producing an increase of intrauterine tension;

one can but foresee overexcitation and consequent overaction. The possibility of spontaneous labor can exist only as a completely differentiated lower segment and an effaced internal os render labor of short duration, giving less time for excitation of the lower segment. In all other cases one can predict manual dilatation and operative delivery, and here the end sought by introduction of the bag should be clearly understood to consist entirely in a softening and enlargement of cervix permitting the ready performance of manual dilatation. Only by such realization can the entire course of labor be formulated, and only thus can the patient be protected from the necessity of demonstrating by hours of unproductive agony the need for operative interference. Manual dilatation of cervix is attended by less extensive laceration when edema is absent. Disappearance of tone occurs with lessened concentration and duration of anesthetic in direct proportion to a shorter period of stimulation. While it is the aim of every physician to afford each individual patient the full opportunity of demonstrating her capabilities, while it is taken for granted that each case demands its right to the test of labor, nevertheless, one must admit that the introduction into the uterus of a foreign body produces an altogether abnormal condition, and that the best interests of the patient are served only by proper interference at the moment when the bag has accomplished its full function, that is at the moment when manual dilatation of the cervix can be readily performed. To prolong expectancy until the cervix is edematous and friable, and until the maximum of lower segment tonicity has appeared, is merely to place trust in powers whose efficiency has been nullified and counterpoised by the primary means employed. It were better by attentive observation to determine the time of manual dilatability than to have this eventually forced upon a reluctant assent. With a wave of enthusiasm existing in favor of version and breech extraction as the elective modes of operative delivery, this becomes all the more necessary. Version and extraction can be quickly and safely accomplished only as the uterus is completely relaxed. Anesthesia in the hands of one inexperienced with the degree of saturation necessary in the presence of lower segment tonicity is rarely productive of peace of mind of operator, dividing his attention, as it does, between the operation and the anesthetic, principally to the latter rather than to the work directly at his hand, and rendering delivery longer, more difficult and more dangerous from the necessarily increased intrauterine manipulation, and more by the descent of the aftercoming head. Extension, delay, forcible extraction, and other complications, to say nothing of forgotten surgical technic, are the aftermath. These may be minimized only as delivery is accomplished before the appearance of lower segment tonicity, or in its early stages before full development. While the average organically nor-

mal patient will withstand prolonged anesthesia to the point of complete pupillary dilatation, the occasional abnormal patient does so only with grave danger. It is, moreover, a tacit admission of ignorance or of lack of attention to permit the full appearance of retraction and the necessity for sublethal anesthesia.

The bag, therefore, in itself, as an agency for the induction of labor, is inadequate: Where it may be successfully employed, it is often unnecessary; expectancy is as certain and more logical. Where necessary, the bag merely precedes manual dilatation, and its use must be recognized as being strictly limited to the production of dilatable cervix.

361 STATE STREET.

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## ON THE GASTRIC JUICE DURING PREGNANCY\*

BY FRANZ ARZT, M.D., ST. LOUIS, MO.

(From the Department of Obstetrics, Washington University School of Medicine)

THE digestive disturbances during pregnancy as well as the changes in appetite and peculiar desires for certain foods, have all been well known and recorded very early in the history of medicine. Nausea and vomiting early in pregnancy, morning sickness so-called, are classified in most textbooks under the heading of the presumptive signs of pregnancy. However, in spite of these well-known clinical facts, very little work has been done on the analysis of the gastric juice during pregnancy, even to the present time.

Kehrer, in 1905, reports the examination of the stomach contents during pregnancy. His findings suggest that there is a decrease in the amount of gastric hydrochloric acid, which he considers usual for pregnancy. His work precedes the introduction of the Rehfuess tube and the present-day fractional method of analysis.

Before starting this work about a year ago, I found no reference in the literature dealing with fractional analysis of the gastric juice during pregnancy. Since this work was started, Tetsutaroo Nakai reported in the *Tokio Journal of Bio-Chemistry*, October, 1925, some recent work on the gastric juice in pregnancy. This journal came to my attention two weeks ago, and since my findings practically coincide with his, I thought it would be well to present these data immediately, although I had hoped to carry the work further before presenting it.

Nakai studied the gastric juice in six cases of early pregnancy (first five months) and in eight cases during late pregnancy. From this work he concludes that during pregnancy the free acidity and total acidity of the gastric juice are lower than in nonpregnant cases, and that this deficiency is more marked during the first half.

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\*Read April 6, 1926, before the meeting of the Washington University Medical Society, St. Louis, Mo.



As I have mentioned, my work on the study of the stomach contents during pregnancy was started a year ago. It was suggested to me by Dr. Otto H. Schwarz, who had previously noted a decrease in the hydrochloric acid in three cases of early pregnancy in which the gastric contents had been examined. I have attempted to examine by the fractional method the gastric juice of the pregnant woman early in pregnancy at a time when the digestive symptoms are most marked, and again in late pregnancy after these symptoms have usually disappeared. Only cases in which the tube was inserted with comparative ease are considered. The existing nausea and vomiting make it difficult in some instances for the patient to swallow the tube, and whenever any difficulty was encountered, such cases were not used.

#### METHOD OF ANALYSIS

The pregnant woman to be examined was instructed to eat nothing after 6 P.M. the day before, and to drink nothing after 6 A.M. the next day, when between nine and ten o'clock she swallowed a Rehfuß stomach tube, through which all of the stomach contents were removed. The tube was allowed to remain in the stomach and was fastened with adhesive tape so that it could neither slide farther down or be pulled out. She then ate a test meal consisting of a shredded wheat biscuit and 300 c.c. of water. Fractions of approximately fifteen c.c. were removed 45, 60 and 75 minutes after the patient actually started eating the meal. Five or ten c.c. of each sample were examined quantitatively by Toepfer's method for free hydrochloric acid and using phenolphthalein as an indicator for total acid titrating against tenth normal sodium hydroxide. Interesting results were obtained as shown in Tables I and II.

Nausea and vomiting in early pregnancy, as the term "morning sickness" implies, occurs most commonly in the morning, usually just after the patient gets out of bed. It is a well-known fact that if the patient before arising, eats a few crackers or a piece of toast and then does not get out of bed until forty-five minutes or an hour later, the nausea and vomiting in a great many cases may be prevented. Now, if we consider the results as outlined in the chart, it will be seen that in both early and late pregnancy there is a marked deficiency of hydrochloric acid in the stomach, and that this hypochlorhydria is more pronounced the first three or four months, the time when nausea and vomiting are most commonly found. It will also be noted that the acidity of the gastric contents is greatest approximately one hour after eating, and it is at this time that the patient is instructed to get out of bed and that the vomiting does not occur. This would suggest some relation between the vomiting and the acidity of the gastric contents. We therefore administered hydrochloric acid in a series of twenty cases of early pregnancy complaining of digestive symptoms, with astonishing results.

A patient, E. M., twenty-nine years of age, gravida iv, two months pregnant, had been vomiting each morning after getting out of bed, and three or four times during the day for three weeks, during which time the patient lost twelve pounds in weight. She was given ten drops of dilute hydrochloric acid in a half glass of

water just before getting out of bed in the morning and before each meal. The patient returned to the clinic three days later and had not vomited since she started taking the acid. Two weeks later, the last time the patient was seen in the clinic, she still had not vomited.

Another patient, B. B., age thirty-eight years, gravida iv, approximately two months pregnant, complaining of vomiting each morning and "heart-burn" after eating, was given ten drops of dilute hydrochloric acid before getting out of bed in the morning and before each meal. She returned to the clinic two weeks later, telling us that she vomited in the morning on two occasions since she started taking hydrochloric acid, and that both mornings she forgot to take her medicine. The "heart-burn" had disappeared.

Using dilute hydrochloric acid, 10 to 15 drops in one-half glass of water before getting out of bed in the morning and before meals, we have treated twenty consecutive cases of early nausea and vomiting of pregnancy in our prenatal clinic. These patients have varied in the number of pregnancies from primipara to gravida viii; in ages from seventeen to thirty-eight years, and include both colored and white.

TABLE I  
GASTRIC ACIDITY IN EARLY PREGNANCY

PT.	DURATION OF PREGNANCY	FREE HCl				TOTAL ACIDITY			
		FAST	45 MIN.	1 HR.	1 HR. AND 15 MIN.	FAST	45 MIN.	1 HR.	1 HR. AND 15 MIN.
M. T.	2 mo.	4	17	18	11	40	32	35	30
F. S.	2½ "	0	0	2	0	30	15	20	16
L. D.	3 "	0	0	0	0	14	10	15	8.5
R. T.	2 "	0	7	11	5	21	28	28	18.5
B. S.	2½ "	0	0	6	27	8.8	8	17	41
M. C.	1½ "	0	6.7	11.1	6	20	18	30	23
J. D.	2½ "	2	3	14	4	14	14	30	18
M. S.	2¾ "	4	0	0	8	20	10	10	24
G. N.	2 "	0	0	0	*	15	16	25	*
A. P.	2 "	6	0	4	10	23	11	24	27
I. B.	4 "	0	0	1	*	6	7	10	*
M. B.	2 "	6	12	15	17	20	34	38	45
F. H.	2½ "	0	10	16	18	14	24	38	37.5
L. C.	2½ "	0	0	0	0	6	7	15	16
C. C.	2½ "	8	4	7	9	25	11	14	23
A. D.	2½ "	0	0	0	0	8.5	12	13	14
E. B.	2 "	0	8	0	*	13	17.5	15	*
A. S.	2 "	0	0	0	0	16	14	20	19

\*No fraction obtained.

TABLE II  
GASTRIC ACIDITY IN LATER PREGNANCY

PT.	DURATION OF PREGNANCY	FREE HCl				TOTAL ACIDITY			
		FAST	45 MIN.	1 HR.	1 HR. AND 15 MIN.	FAST	45 MIN.	1 HR.	1 HR. AND 15 MIN.
Mrs. M.	8 mo.	12	6	16	25	23	16	28.5	33
R. T.	7 "	18	19	23	20	26	28	33	32
M. C.	5 "	6	*	12	*	22	*	26	*
F. S.	6½ "	0	4	10	12	17	21	26	32
G. N.	7½ "	0	16	2	0	10	30	10	15
J. E.	8 "	7.5	0	0	0	37.5	12	13.7	15

\*No fraction obtained.

TABLE III

## RESULTS

NUMBER OF CASES	SYMPTOMS	RESULTS
10	Nausea and vomiting.	Nausea and vomiting completely stopped.
7	Nausea and vomiting.	Nausea and vomiting greatly relieved. Now vomit once a week or less.
1	Nausea in A.M. and after meals.	Nausea completely stopped.
1	Heart-burn after meals, some nausea, no vomiting.	Heart-burn and nausea greatly improved. Now occasional.
1	Nausea frequent; vomiting two or three times a week.	No improvement.

At the suggestion of Dr. Duff Allen of the Department of Surgery of Washington University, who is at present working on the formation of  $\text{CO}_2$  in the stomach, chloride determinations were made on eight cases of this series. Dr. Allen is of the opinion that this gas is formed chiefly by the regurgitation of the duodenal contents, due to reverse peristalsis. The sodium carbonate of the duodenal contents reacts with the hydrochloric acid of the gastric contents to form sodium chloride, carbon dioxide and water. On hearing of my work, Dr. Allen felt that this low acidity might be due not to actual deficiency in the hydrochloric acid contents of the stomach, but due to a neutralization of the acid,

TABLE IV

## TOTAL CHLORIDE OF STOMACH CONTENTS IN PREGNANCY

PT.	DURATION OF PREGNANCY	FASTING CONTENTS	45 MIN.	1 HR.	1 HR. AND 15 MIN.
J. D.	2½ mos.	56	41	44	51
M. S.	2¾ "	75	23	22	37
I. B.	4 "	80.3	56.1	69.7	80.9
M. B.	2 "	69.7	61.2	68.0	69.7
F. H.	2½ "	93.5	57.8	68.0	74.8
F. S.	6½ "	52.7	50.8	56.1	67.6
G. M.	7½ "	90.9	46.7	78.2	113.2
M. C.	5 "	85.0		96.9	

with the formation of sodium chloride as a result of regurgitation of the duodenal contents. If this be the case, the gastric contents should, in spite of the low free hydrochloric acid contain a normal, or possibly an increased amount of total chlorides.

In eight determinations of total chlorides carried out by Dr. Allen on these cases, it will be seen that the total chlorides were normal, or even increased (see Table IV). Although the results outlined represent data from only a few cases, they tend to show that free hydrochloric acid in the stomach contents is not due to an actual deficiency of secretion, but to the neutralization of the acid by alkaline salts regurgitated from the duodenum into the stomach. It is suggested

by Dr. Allen that the reverse peristalsis causing the regurgitation might be reflex from irritation from the early pregnant uterus. This has been previously suggested by Alvarez.

#### CONCLUSIONS

1. That the free hydrochloric acid and total acid of the stomach contents are lower in pregnancy than in the nonpregnant, and that this deficiency is more marked early, at the time that nausea and vomiting are most common.

2. That dilute hydrochloric acid by mouth is indicated in preventing early nausea and vomiting of pregnancy in certain cases.

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### REFERRED PAIN IN THE SHOULDER IN RUPTURED TUBAL PREGNANCY

BY W. C. DANFORTH, B.S., M.D., F.A.C.S., EVANSTON, ILL.

ANY means of rendering differential diagnosis easier and clearer is of value. The diagnosis of unruptured tubal pregnancy is often difficult. The recognition of ruptured ectopic pregnancy is, in the majority of cases easy. When the loss of blood has not been extreme and the signs of hemorrhage, as pallor and increased pulse rate, are consequently not so marked, error may occur. The possibility of such error is evidenced by the two cases reported here, as well as the possibility of avoiding error by the consideration of the significance of pain in one or both shoulders which occasionally occurs in intraabdominal hemorrhage from ruptured tubal pregnancy. All who have made use of transtubal insufflation to determine the patency of the fallopian tubes have noted the frequency of pain in one or both shoulders in those cases in which normally patent tubes permit the passage of gas into the abdomen. This occurs after the woman assumes the sitting posture, after insufflation. The gas seeks the highest point in the abdomen and finds its way between the diaphragm and the superior surface of the liver, causing the falciform ligament to be pulled upon. The consequent stimulation of the phrenic nerve, and its relation with nerve trunks springing from the third, fourth and fifth cervical cord segments, causes pain to be felt in the shoulders. If the woman lies down, particularly if the lower part of the body be elevated, the pain soon ceases as the gas leaves the subphrenic space.

In rupture of the pregnant tube, particularly if considerable intra-abdominal hemorrhage occurs, blood may enter the subphrenic space

and cause traction upon the falciform ligament in the same manner as it is produced by the gas. This is especially apt to be so if the bleeding is large in amount and if the rupture of the tube is followed by faintness. The patient then is likely to lie flat for a time and often the foot of the bed is elevated. This allows the fluid blood to run upward along the colon on both sides, particularly the right side, and to find its way into the subphrenic space. At the time of operation enough blood is removed or escapes through the wound, even though the operator does not try to remove any great amount, that the pain is not felt after operation. Two cases of ruptured ectopic pregnancy in which shoulder pains were noted were reported by Rubin in 1923. He states that this sign had been noted in four cases in all in the Mt. Sinai Clinic.

We have noted the presence of shoulder pain in ruptured ectopic pregnancy in two cases.

CASE 1.—A woman of thirty-one, pregnant two months, was admitted to the medical service. Four days previously she had had a sudden sharp abdominal pain. She had skipped two periods but for two weeks before the onset of pain had had "spotting." On admission she complained chiefly of pain in both shoulders, particularly the right one. The physician attending, Dr. John McClellan, suspected some intraabdominal condition and asked a general surgeon to see her. The surgical consultant believed that either a cholecystitis or a beginning pneumonia with diaphragmatic pleurisy must be present, feeling that the shoulder pain could not be accounted for otherwise. Two days later I was asked to see her. The menstrual history, the sudden lower abdominal pain, followed by pain referred to the shoulders, the leucocyte count of 16,000 on admission declining to 9,000 the day of my examination, hemoglobin 65 per cent, and marked tenderness on the right side elicited by vaginal examination made a diagnosis of ectopic pregnancy very easy. On opening the abdomen a right tubal pregnancy was found with intratubal rupture. The hemorrhage had occurred at the distal end of the tube and had not been excessive in amount. About one pint of free blood was found in the abdomen. No attempt was made to remove the blood. The patient recovered uneventfully. No shoulder pain was felt after operation.

CASE 2.—This case is reported through the courtesy of Dr. W. R. Parkes and Dr. Ben H. Huggins. Woman aged twenty-eight, was pregnant six weeks. At 2 A.M. sudden severe abdominal pain followed by faintness. She was brought to the hospital at 9:00 A.M. After admission it was noted that pain was present in both shoulders. Leucocyte count was 18,000, pulse 120, temperature 97.6°, blood pressure 86/54. Diagnosis of ectopic pregnancy was not made. Exploratory operation by Dr. Parkes revealed a left tubal pregnancy with a large amount of blood in the abdomen. Recovery was uneventful. No shoulder pain was felt after operation.

In Case 1 a well-known surgeon and teacher was led to consider upper abdominal or possible thoracic pathology by reason of the shoulder pain which he did not associate with trouble in the pelvis.

In Case 2 the shoulder pain introduced an element of doubt which caused the diagnosis to remain undetermined although she was seen by an experienced general surgeon. It is true that neither the surgeon who saw the first case nor either of the attendants in Case 2 had had

any occasion to become familiar with the sensations of patients who have undergone tubal insufflation.

The symptom of shoulder pain in intraabdominal bleeding from ectopic pregnancy, properly understood, may well be a help rather than a hindrance in diagnosis and may be of value in differentiating this condition from other abdominal conditions. It seems proper again to draw attention to it.

708 CHURCH STREET.

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## REPORT OF A CASE OF ACRANIA CAUSING MALPRESEN- TATION AND ACCIDENTAL HEMORRHAGE\*

BY A. J. FLEISCHER, M.D., NEW YORK, N. Y.

**K**NACKSTEDT, in 1791, described the anatomy of a fetus born without brain and skull. Many others since have reported such cases of anencephaly, acrania, etc. Thoms in 1918 reported a case of anencephaly, where there was a marked familial prevalence. In 1924, Campbell and Willits reported a case of anencephaly diagnosed before birth, with the aid of radiography. DeLee points out that, "during labor the possibility of a monstrous formation is to be considered, with other things, when the internal examination reveals atypical findings." Another quotation from DeLee: "An anencephalic monster might easily cause confusion with placenta previa, prolapse of the cord, simple face presentation, or breech presentation." The following case of acrania with meningocele fully illustrates these two quotations.

### CASE REPORT

Mrs. F. H., aged twenty-six, primipara, was admitted to the Bronx Hospital, July 20, 1925, complaining of pains in the abdomen and vaginal bleeding. Family history revealed death of father due to meningitis, at the age of fifty-three; two brothers died in infancy, cause unknown; two brothers and three sisters living and well. There is no history of monstrosity in either the patient's or her husband's family. Patient had measles in childhood and typhoid fever at the age of eighteen. Menstruation began at fourteen, every thirty days, of four days' duration, and moderate bleeding. She felt quickening on April 28, 1925. Urine always negative, blood pressure never above 115/68. Measurements: Interspinous, 20; intercrystal, 24.5; left oblique, 19; right oblique, 20; external conjugate, 18; diagonal conjugate, 11.5.

Labor pains began at midnight. Membranes ruptured at 3:00 A.M., after which patient noticed spotting. She was admitted at 4:20 A.M., having strong pains about every five minutes. The house obstetricians reported: eight months' gestation; dilatation three fingers, membranes ruptured, breech presenting, and constant bloody oozing from the vagina. At 5:00 A.M. the cervix was markedly thinned out, four fingers dilatation, face presentation, left mentoposterior. Fetal heart was 140, heard in right lower quadrant of the abdomen, and good quality. No placenta could

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\*Presented at a meeting of the Obstetric Section of the New York Academy of Medicine, January 26, 1926.

be felt, but it was believed the bleeding might be due to premature separation. The fetal mouth imparted to the examining finger a sense of unusual largeness and irregularity, suggesting harelip. A protruding mass was felt over the right orbital fossa. The findings pointed to a monstrosity as accounting for the malposition. Although the pulse was 120, where it had been 88 on admission, it was decided to wait, since the general condition was good, for the cervix to dilate, if not completely, to a stage where manual dilatation would be justified. At 5:30 A.M. she began to feel restless, pulse had gone up to 140, and bleeding was more profuse. Immediate delivery was decided upon. The cervix was almost completely dilated, and with the aid of a little manual manipulation, appeared sufficiently out of the way to effect delivery by means of version and extraction. While completing delivery of the after-coming head, a large meningocele was noticed, to which the fetal membranes were strongly adherent. The free hand placed in the vagina, while supporting the fetus with the other hand, immediately came upon the after-coming placenta, which had apparently already been separated and was being extracted along with the after-coming head. Continuing extraction with the utmost care, a living female child and placenta were completely removed, preserving the attachment of the fetal membranes to the meningocele. Uterine bleeding was controlled with pituitrin and aseptic ergotol, hypodermically. The child lived for two hours.

The dome of the calvarium was missing. The brain was included in a meningocele that extruded from the opening in the skull. From the apex of this meningocele, there extended a fold of membrane to the amnion reflected from the root of the cord at its insertion in the placenta. This insertion was eccentrically placed, practically at the outer margin of the placental circumference. The maternal side of the placenta, corresponding to the fetal side where the cord was inserted, indicated that the separation had taken place at this point, which was the seat of the hemorrhage. The brain of the fetus was unusually well developed, considering the fact that in this type of monstrosity, this is not usually the case. There was marked exophthalmus of the right eye; also double harelip and cleft-palate. Syndactylism was present in both lower and upper extremities. The thymus was large, as one would expect in a newborn. Heart was normal, lungs were atelectatic. Examination of the abdominal and pelvic organs revealed no abnormalities.

It would appear that, with every uterine contraction, traction on the adherent amnion and placenta resulted in premature separation, with consequent accidental hemorrhage. For the same reason, there was countertraction on the head, preventing flexion, with resulting extension and face presentation.

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2240 GRAND CONCOURSE.

# REPORT OF A CASE OF CONGENITAL MALFORMATION AND ARRESTED DEVELOPMENT OF THE COLON\*

BY GEORGE KIRBY SIMS, B.Sc., M.D., JOPLIN, MO., AND HARRY L.  
MEYERS, M.D., CHICAGO, ILL.

**B**ABY R., a girl, one month premature, breech presentation, weight 1833 grams, delivered at the Chicago Lying-In Hospital, February 24, 1925, was considerably asphyxiated. With catheter a moderate amount of mucus was removed from the trachea. After a subcutaneous injection of 0.5 c.c. of alpha-lobelin the child made a satisfactory recovery.

Following each feeding for the first sixty hours the baby regurgitated. It passed nothing per rectum. After the first twenty-four hours there was a moderate amount of icterus which, with the ingestion of water at frequent intervals, cleared up during the succeeding thirty-six hours.

Physical examination revealed an asthenic baby with the skin of the extremities somewhat wrinkled. There was no apparent discomfort; the child slept well, and cried very little, though lustily. The eyes, ears, nose, and throat were normal. There was no adenopathy. The heart was regular and no murmurs could be heard. The chest revealed no abnormal findings. The abdomen was greatly distended, especially in its upper half, where it was highly tympanitic. The genitalia were normal.

A rubber catheter was passed into the duodenum without any difficulty. Further, a catheter was passed per rectum to a distance of about 10 centimeters, when it met with resistance. A tentative diagnosis of acute obstruction at the ileocecal junction was made.

The blood Wassermann was negative; likewise, that of the mother and father. A barium mixture was injected per rectum with the catheter left in situ, reaching to the point of resistance, as previously described. The roentgenogram revealed a light colored, ribbon-like band 0.5 centimeters width, extending from the region of the ileocecal junction, upward on the same side a distance of four or five centimeters, then across the abdomen just below the umbilicus to the left costal arch, and downward to midline and to the lower part of the pelvis. The catheter was seen to lie in a straight line directly over the spine.

After removing the catheter the patient was returned to its crib for six hours, during which time nothing was passed per rectum. A second roentgenogram failed to reveal the shadow in that part of the intestinal tract in which the catheter lay, as was shown in the preceding film.

Operation, February 27, 1925.—The abdomen was opened through a median incision extending from symphysis to umbilicus. The ileum, distended in practically its entire length to four or five centimeters in diameter, came into view. It was purplish in color, except for five or six centimeters at its distal end, which was of a pinkish hue and tapered down to near its normal size.

The appendix was free, and of normal size and color, though in malposition and attached to the distal end of the ileum. There was no constriction at the pylorus. The liver extended to the iliac crest. The urinary bladder, uterus, and tubes were normal. A white, firm, cord-like structure, about 5 centimeters in diameter, with no palpable lumen, was found beginning at the ileocecal junction, passing upward and diagonally across the abdomen just below the umbilicus to the left costal arch, then down to the crest of the ilium of the same side. From here, this structure,

\*Read before the Jasper County Medical Society of Joplin, Mo., February 2, 1926.



which proved to be the colon, though it had no vestige of a mesentery in any of its entire length, passed downward to midline and in this plane into the pelvis. It was not only impossible to pass meconium through the ileocecal valve, but even gas from the distended ileum could not be forced through.

A rubber catheter was passed per rectum, but was observed to stop after it had entered the gut a distance of about 10 centimeters. A puncture was made into the small intestine to permit the escape of gas, after which the wound was closed by a Connell suture. The viscera were replaced in the peritoneal cavity; the peritoneum, muscles and fascia were closed with continuous sutures of catgut No. 2 and the skin with interrupted linen.

Postmortem examination revealed no abnormality of the patient other than that heretofore described. The entire colon was removed and sectioned at 2.5 centimeter intervals. A section was made from each of these segments. Microscopic examination of the sections made from the first few segments revealed no lumen. In the remainder of the gut the diameter of the lumen was of a graduated size, ranging from that of the diameter of an ordinary brass pin to 1 millimeter, except the rectal portion, which was about a centimeter in diameter.

In reviewing the literature, we have found eleven cases which, in any manner, bear resemblance to the one being described.

The colon of arrested development (microcolon) is of unusually rare occurrence and is not discussed in standard works.

In the cases which follow, the writers confine themselves to a description of the case with no discussion of the probable cause or development of the anomaly or malformation.

In Kennedy's<sup>5</sup> case the atrophied intestine was removed from a girl of twenty years. Two years preceding the operation a subcostal abscess in the right side was diagnosed as tuberculous. Three weeks preceding the operation a fecal fistula developed. A resection was done, followed by a lateral anastomosis about the middle of the transverse colon. Examination of the muscle fibers of the atrophied ascending colon proved that it was of congenital origin.

Walker<sup>8</sup> reports on three consecutive infants in one family, all of which succumbed shortly after birth. No autopsy had been permitted, but two had come to operation. In each of these there was imperforate anus, and at operation no large intestine could be found. In one, on opening the abdomen, a firm, cord-like structure about 0.5 centimeters thick was found running up from the occluded lower gut and attached to the abdominal wall by a small fold resembling a rudimentary mesentery.

Autopsy in Gellert's<sup>3</sup> case showed that the large intestine was represented by a pale, contracted band which would admit only a small-sized probe. From the diminutive cecum downwards, the colon was markedly attenuated, poorly developed, and in a gradual decline, especially so below the hepatic flexure. A minute appendix was present. A thin plug of inspissated mucus was found blocking the lumen of the gut in the region of the splenic flexure. The large intestine was present in its entirety and no atresia or occlusion, apart from the plug of mucus, was observed in any part of the colon. The condition of the large bowel was obviously due to malformation, microcolon, a developmental error in early fetal life, and did not represent a state of collapse below an obstruction.

Stowell<sup>7</sup> reports a case of arrested development of the intestinal tract in which the stomach was 6 centimeters long with a constricted pylorus. The duodenum was dilated for 6 centimeters until another constriction cut it down. Beyond this point the intestine was a large pouch, 25 centimeters long, ending abruptly and blindly. There was, then, a cord-like remnant of 10 centimeters of gut, ending in the atrophied remainder of the ileum which was 1.5 centimeters in diameter and

collapsed. The appendix was 4 centimeters long and was attached to the first part of the duodenum. The colon, except the rectal portion, was less than a centimeter in diameter. The rectum was pervious but small.

Coley<sup>1</sup> reports a case in which the small intestine was dilated 3.5 centimeters to within 20 centimeters of the cecum. The remainder of the bowel was like a tape.

Craig<sup>2</sup> reports a case of the colon atrophied to that of the size of a quill.

In Horn's<sup>4</sup> case the colon was a solid, cord-like structure and showed throughout its entire length, from the cecum to the rectum, a high grade stenosis. Topographically, it was correctly located, but only of lead-pencil thickness. This author maintains that his case is of greatest rarity; he has found only one other similar case reported, that by Brodelet, in 1854, which showed atresia at the cecum, below which the entire intestine was very much contracted. Cases showing atresia in parts of the intestinal tract are of more frequent occurrence. The author adheres to Kreuter's theory, that congenital, colonic anomalies find their explanation in an arrest, and in the persistency of arrest, of embryonal development.

LeConte, Lee and Downs<sup>6</sup> report a case of arrested development of the alimentary canal in an adult. In this instance, however, the pathology involves a malposition and a malformation of the colon with an omentum attached. But the lumen of the gut rather than being narrowed, was very decidedly enlarged and more nearly resembled the condition of megacolon.

#### SUMMARY

1. Walker,<sup>8</sup> in referring to two of his cases which came to operation, says no large intestine could be found. His statement is somewhat misleading, inasmuch as he states that the abdomen was opened in only one case. And in this one there was a cord-like structure with a rudimentary mesentery attaching the cord to the abdominal wall. After all, he does not tell us whether there was a lumen in the gut.

2. Coley<sup>1</sup> also leaves us in doubt in the matter of a lumen in the rudimentary intestine referred to in his case, saying, merely, that the colon in his case was like a tape.

3. Horn<sup>4</sup> reports that the colon in his case had a high grade stenosis.

4. The other writers in reviewing their cases reveal that there has been either an arrested development of the colon with a consequent stenosis or a congenital malformation.

5. A review of all the cases from the literature available in the John Crerar Library of Chicago shows that case not only presented a congenital malformation and arrested development, in that there is only a very small cord-like structure with no lumen in the first third of its entire length and a high grade stenosis in its remainder, but that there is a total absence of a mesentery.

#### REFERENCES

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<sup>3</sup>Gellert, H. H.: Lancet, 1920, i, 911.

<sup>4</sup>Horn, W.: Klin. Wehnschr., 1922, i, 2141.

<sup>5</sup>Kennedy, I.: Tr. Roy. Acad. Med. Ireland, 1915, xxxiii, 215.

<sup>6</sup>LeConte, Lee, and Downs: Ann. Surg., 1924, lxxx, 217-221.

<sup>7</sup>Stowell, W. J.: Am. Jour. Obst., 1895, xxxii, 75.

<sup>8</sup>Walker, A. S.: Med. Jour. Australia, 1919, i, 216.

## SPIROCHETAE IN THE THYMUS GLAND. A CASE REPORT

By JAMES R. McCORD, M.D., ATLANTA, GA.

*(From the Department of Obstetrics, Emory University School of Medicine)*

**WE BELIEVE** the following case, showing the uncertainty of syphilis and pregnancy, is worth reporting.

B. D., a colored primiparous woman, was admitted to the hospital January 10, 1926. She was an eclamptic, having convulsions, and was not at term. The maternal prelabor Wassermann was negative. Labor was induced by a bag, and she delivered a macerated baby, weighing four pounds, one ounce. The placenta showed none of the histologic evidences of syphilis. An x-ray picture of the bones of the baby

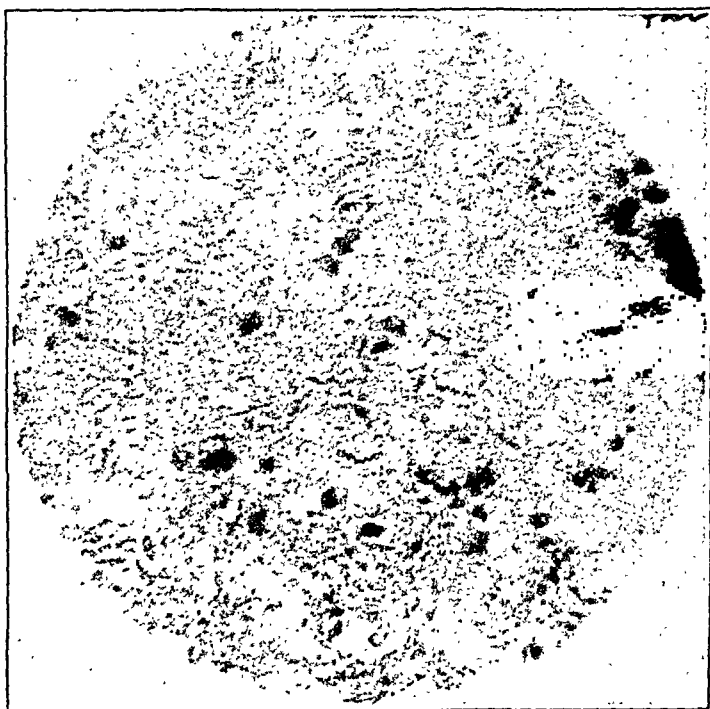


Fig. 1.—Showing *Spirocheta pallida* in the thymus.

did not show any of the changes that are believed to be characteristic of syphilis. A dark-field examination of liver secretion did not show the spirochetes of syphilis (this may have been due to the maceration of the fetus, or perhaps the organisms were overlooked). The fetal tissues removed at autopsy were stained by Levaditi's method. Thorough search revealed no organisms in the liver, spleen, kidneys, adrenals, heart, or aorta. They were found in the thymus in large numbers. We know that any silver stain, for the organisms of syphilis, is unreliable; but all of these tissues were carried through at the same time, and the only conclusion we can draw is, that the organisms were only present in the thymus gland. If present in other tissues, their numbers must have been exceedingly small.

61 FORREST AVENUE.

# Society Transactions

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## OBSTETRICAL SOCIETY OF PHILADELPHIA

MEETING OF FEBRUARY 4, 1926

THE PRESIDENT, DR. NORMAN L. KNIPE, IN THE CHAIR

DR. STEPHEN E. TRACY presented a specimen from an **Extensive Myomectomy** and referred to the safety with which this can be done under modern methods.

Mrs. Chas. M., aged thirty, married two years, never pregnant. Menstruation began at the age of fifteen, regular every twenty-eight days, and lasted six to seven days. At times the menstrual period was painful for a few hours until the flow was well established. For the last year the patient complained of pain and sensation of fullness in the left side of lower abdomen and pelvis. Examination of the abdomen was negative. Posterior to the cervix there was a hard, smooth mass extending to the left side, which filled the pelvis, and above which some small nodules could be made out.

A diagnosis was made of fibromyoma and operation was recommended.

The patient was most anxious to become a mother and was promised the uterus would be saved if possible. A large nodule measured 12 by 6 cm., and 10 other nodules, varying in size from 4 by 3 cm. down to 1 cm. in diameter, were removed. At the completion of the operation the uterus was about normal in size and of normal contour. Examination just before the patient left the hospital showed the uterus to be of normal size, normal in position, and freely movable.

In answer to Doctor Outerbridge, whether the scar in the uterus would stand a labor, Dr. Tracy said he had no definite data on cases in which the endometrial cavity was opened for a myomectomy. If the wound in the uterus is carefully sutured and if the patient has a normal convalescence and primary union, there should be no trouble from the scar during labor.

DR. WILLIAM W. VAN DOLSEN described **A New Type of Obstetrical Forceps**.

Feeling that there was no excuse for the fenestrated blade and having seen many lacerations of the child and mother following its employment, he selected the solid blades used in the Tucker-McLane instrument as a basis for this instrument. Particular care is used in beveling the edges of the blades and shanks, thus leaving the least possible cutting surface.

The pelvic curve of the Dewees' forceps being the greatest and giving more of the axis traction principle, was therefore copied. The lock and cross shanks of the Elliott instrument cause less distention of the vaginal floor with subsequent danger of laceration, and so it was considered more desirable as compared with the Simpson forceps.

The Elliott adjustment, for holding the handles at a certain distance and avoiding undue compression on the fetal head, was used with the addition of a notch filed on the adjustment bar. This notch is placed at a point guaranteeing the adjust-

ment of the tips of the blades at 1.5 cm., and the diameter of the blades at their central point at 10 cm., the largest diameter of the fetal head. By turning the adjustment past the notch the diameter between the blades may be altered.

Noting that on all other forceps the handles are fitted with projecting wings, so small as to be painful and tiring to the fingers, he made the handles on his forceps large enough to hold comfortably two fingers on either side.

DR. RICHARD C. NORRIS believed that attempts to do away with the principle of axis traction was distinctly a backward step. He regarded the increased concavity of the blades of this instrument as being a distinct disadvantage from the standpoint of compressing the child's skull and increasing the intracranial hemorrhages which we now know are the important factors in cases of grave asphyxia.

DR. GEORGE M. LAWS read a paper on **Ureteral Obstruction in Women.**  
(For original article see page 802.)

#### DISCUSSION

DR. GEORGE W. OUTERBRIDGE agreed with Dr. Laws that it is perfectly feasible to use these bougies through a water distention, indirect vision cystoscope. He says it should be remembered that a diagnosis cannot be made in these cases on one examination.

Dr. Outerbridge said that in many cases obstruction to the catheter is found at one time, while at another time the catheter passes without any difficulty. He described one very striking personal case. The patient had symptoms suggesting ureteral and kidney trouble and he could not get a No. 6 bulb through either ureteral orifice, but managed with great difficulty to pass a No. 5. It went so tightly that the ureteral orifice became blanched and puckered and the woman had a terrific reaction afterward. She was cystoscoped six days later and both ureteral orifices were edematous. Six months later she returned for treatment and it was possible to pass a No. 10 bulb without any trouble. The relation of pyelitis to obstruction is one of great interest. Pyelitis will not clear up in the presence of definite obstruction. In pyelitis of pregnancy the passage of a ureteral catheter clears the symptoms very quickly, and no doubt obstruction is relieved and drainage produced. But does the urine clear up bacteriologically? A great many of these cases if examined long after the termination of pregnancy will have colon bacillus in their urine. Dr. Outerbridge referred to one patient, a woman, who came in with marked pus in the urine, no definite obstruction of either ureter, cloudy urine on both sides; one side appeared normal in pyelogram, the other showing a moderate but definite hydronephrosis. There was a slight hang to the No. 12 bulb on the hydronephrotic side at about 22 cm. above the orifice; on the other side there was no obstruction at all. That woman received ten pelvic lavages and ureteral dilations at intervals of ten days to two weeks. The pus and her symptoms have cleared up but every examination still shows colon bacillus in the urine although the urine is perfectly clear. There is no demonstrable dilatation of the ureter, yet the pyelitis is, so far as bacteriologic study goes, as it was at the beginning.

Dr. Laws referred to the fact that the back pressure in the kidney parenchyma existed without dilatation of the kidney pelvis. It might be asked whether that lack of dilatation of the pelvis was a pathologic finding after the kidneys were removed, or how it was demonstrated?

Dr. Outerbridge also had a case in which there was an obstruction of the ureter that went on to complete disappearance of all evidence of the ureter cystoscopically. Of course cases of so-called "closed kidney" are not very rare, but

as a rule at least the ureteral orifice remains and can be seen in the bladder. This patient recently came in suggesting trouble in the left kidney and a cystoscopy showed apparently an instance of single kidney. There was no left ureteral orifice whatsoever, the left bladder wall being absolutely smooth. He had cystoscoped this woman four years before and she had then a normal left orifice. On operation she proved to have a tuberculous left kidney with cyst formation and calcification. That of course is the ultimate finding of ureteral obliteration due to tuberculosis.

DR. J. STUART LAWRENCE asked what percentage of acute obstruction existed.

DR. H. M. GINSBURG said he had made a careful study of ureteral strictures and felt the same as Dr. Laws about diagnosis. He uses the direct method of cystoscopy with a modified Kelly cystoscope and the patient in the knee-chest posture. In order to exclude stricture of the ureter it is necessary to use a No. 9 or 10 catheter, or a small catheter upon which is placed a wax bulk equivalent to 10 mm. The majority of the cystoscopes will only allow the use of a catheter as high as No. 7; it was therefore taken for granted that this was the normal caliber of the ureter. Strictures of the ureter are found very frequently in the Gynecological Department of the Jefferson Hospital. Patients come in with indefinite abdominal pain. Pelvic examinations, gastrointestinal and other studies are made and the origin of their symptoms is determined only after careful urologic study. If their pain happened to be on the right side, the majority of these patients have had their appendix removed. Of course to make an absolute diagnosis of stricture of the ureter it is necessary to use a wax bulb or to make a pyelogram. In the majority of the patients the diagnosis can be made by finding a definite obstruction to the larger sized catheters. It is surprising to find the excellent urinary output in these cases even where there is a moderate degree of hydronephrosis. In the majority of the women who suffer from frequency of urination, the trouble is usually limited to the trigone, in other words they are suffering from a trigonitis and not from a cystitis as we so commonly surmise. If one examined these patients by the indirect method, the ureteral orifices would appear normal, due to the magnification of the fluid in the bladder, and if one examined the same patient by the direct method the orifices would appear small and round and sometimes pointing. This condition is often secondary to the trigonitis or follows a ureteritis, and for this reason obstruction is often at the ureteral orifice.

DR. CHARLES MAZER said that in addition to the "hang" on the bulb catheter, the ureterogram is the principal diagnostic feature in ureteral stricture. It is impossible to conceive of the presence of a stricture without dilatation of the ureter above the point of obstruction. He injects the sodium iodide with the patient in the recumbent position, and withdraws the catheter when the patient is in the extreme Fowler position (almost erect) so that the solution fills the ureter by gravity and not by pressure from below. He believed that the reason Dr. Outerbridge failed to obtain negative cultures after the urine was made free from pus was his failure to eradicate primary foci of infection. A careful study of the nose, throat, and sinuses as well as the uterine cervix must be made in order to eliminate these as causative factors.

There are cases of ureteral kinks attributable to abnormal mobility of the kidney, usually occurring in women who, for some reason, have lost much weight. A pyelogram made in the extreme Fowler position will show a difference of from two to four inches from that made with the patient in the recumbent position. These cases are usually associated with dilatation of the kidney pelvis and ureter above the point of kinking. Dr. Mazer treated these patients by rest in bed in the

Trendelenburg position for six weeks, and by forced feeding. On discharge, proper abdominal support was provided.

DR. LAWS (closing) said in answering Dr. Lawrance's question, that he had no knowledge as to how often inflammatory stenosis follows pyelitis, and did not know how one could determine it. When the pyelitis clears up one does not feel like subjecting a patient to an examination of this kind without a reason, for if the patient has a fairly normal urinary tract a medium-sized catheter will cause little or no reaction, but if the patient has an obstruction in the ureter and a full-sized instrument is put in she will have a reaction which may be quite severe. Answering Dr. Outerbridge's question about the pathologic material shown there, it is true that of the seven cases pictured there were two in which the kidneys had been suspended; they were biopsy sections and so far as one could tell clinically, without a pyelogram, there was no recognizable hydronephrosis. Of the other five, some had pyonephrosis, others had not. These parenchyma changes may occur in the absence of dilatation of the pelvis. Dr. Ginsburg spoke of congenitally small ureteral orifices. Dr. Laws said he was sure there were two or three patients in that group who had very advanced trouble. One patient had had a suspension and she had a normal appearing orifice, but it was so small that he was unable to pass a catheter of any size. When first seen she had a huge pyonephrosis. Of course pyelograms were not made in the cases that had pyonephrosis and conditions requiring nephrectomy; there was no reason for it. In cystoscopic work Dr. Laws always acted on the basis of doing the minimum that was necessary for the welfare of the patient and it left him with a dearth of pictures. In the years in which some of this work was done a pyelogram was not a thing to be done without a little consideration because he was not always using an innocuous medium like sodium iodide. Making pyelograms should not be a routine procedure.

DR. B. G. M. ASTLEY read a paper on **Spinal Anesthesia**. (To appear with its discussion, in the January issue.)

#### MEETING OF MARCH 4, 1926

DR. BERNARD MANN reported a case of **Primary Carcinoma of the Ovary**.

Although primary carcinoma of the ovary is quite uncommon the solid type is rarest. Mrs. S. J., widow, colored, aged forty-six, was admitted to the Howard Hospital, December 20, 1925, complaining of pains and swelling of the abdomen, vomiting, and dyspnea. She was confined to her bed for about four months. Menstrual history was normal; menopause two years ago. She had seven children, four of which were premature. Blood Wassermann, four plus; R. B. C., 2,500,000; Hb, 60 per cent; W. B. C., 15,000. Blood pressure, 84/50.

Patient was poorly nourished. No edema of the extremities or face. Murmurs both at aortic and mitral areas. Bases of both lungs revealed fine rales. Abdomen was markedly distended. Movable dullness. A solid mass could be outlined in the lower abdomen, reaching above the umbilicus. On January 5, 11 pints and 13 ounces of bloody-colored fluid were removed from the abdomen, which relieved the patient considerably. Patient required tapping again 5 days later and 8½ pints of fluid were removed.

On January 15, under local and sacral anesthesia, the abdomen was opened through a midline incision. About 10 pints of bloody-colored fluid escaped. The tumor was adherent to the peritoneum, omentum and transverse colon, and occupied the site of the right ovary. The right tube was small. The uterus was about

normal size, and the left tube and ovary were normal. After removal of the tumor, there was marked bleeding from its bed and the pelvis was packed. The



Fig. 1.—Carcinoma of ovary. Low power.



Fig. 2.—Carcinoma of ovary. High power.

patient made an uneventful recovery with no evidence of reaccumulation of the fluid. She was given digitalis and mixed treatment.

At time of discharge on February 17, she was able to walk about, free from any pain or discomfort, and entirely relieved of her dyspnea, vomiting, and abdominal distention. Blood pressure 114/70.



The gross specimen submitted for examination was a large lobulated and nodulated tumor, largely solid in type, but with a few small cystic areas in it, about the size of an adult human head and weighing 2200 gm., with a thin, pale, almost translucent capsule, and fleshy, slightly spongy texture of the interior tissue. Microscopic examination showed a thin, fibrous capsule, and an alveolated arrangement of the tumor tissue, the alveolar walls fibrous and thin, and the spaces lined and more or less filled by comparatively large epithelial cells, often columnar in type where lining the alveolar walls but were modified by mutual pressure in the alveolar interiors. Extensions of these cells through the matrix were frequent, and examples of free cellular proliferation into the alveolar spaces from the lining as papillary bunches common. Occasional small cysts containing a pseudomucin were seen; and sometimes this serous material along with the epithelium served to fill the spaces. No definite ovarian structure was encountered in the sections examined. *Diagnosis:* Adenocarcinoma of the ovary.

**DR. LEWIS S. SCHEFFEY** reported a case of **Spindle-Cell Sarcoma of the Ovary With a Twisted Pedicle**, removed by Dr. Brooke Anspach.

The patient, Mrs. R. W., married, thirty-seven years of age, was admitted to the Jefferson Hospital because of acute, paroxysmal pain in the left lower abdominal quadrant, accompanied by a palpable enlargement. She exhibited profound weakness and was rapidly approaching collapse.

The condition had developed rather suddenly on the morning of admission, beginning with acute abdominal pain, more marked on the left side, and increasing in intensity and severity; an hour or so later, sudden weakness occurred, amounting almost to collapse, and these symptoms, together with the finding of a palpable enlargement in the left lower abdominal quadrant, justified the diagnosis of ovarian cyst with a twisted pedicle.

Operation revealed a solid tumor of the left ovary, 10 cm. in its longest diameter; two complete twists of the pedicle; hemorrhagic infiltration and enlargement of the left fallopian tube, the size of a carrot; the other pelvic organs appeared normal, with the appendix uninvolved. A left salpingo-oophorectomy was performed, with posterior fixation of the left round ligament. A Baldy-Webster fixation of the right round ligament, and appendectomy were also done, and the patient made an uninterrupted recovery with an uneventful convalescence.

The pathologic report showed the tumor to be a spindle-celled sarcoma of the ovary. Important in the history was the fact that the patient had noted progressive abdominal enlargement for three months prior to this attack, but had never experienced any pain, and had never mentioned the matter to anyone. Menstruation had been irregular for three years past, occurring every one to three months, normal in amount, with some dysmenorrhea. She had been pregnant four times, with two miscarriages and two labors, one a twin birth; the last pregnancy occurred five years previous to this attack. Otherwise the history, both personal and family, was uneventful.

**DR. JOHN H. GIRVIN** reported an instance of **Unusually Large Ovarian Cyst**.

Mrs. M. K., aged forty-six, white, married, with 3 children, no miscarriages, was admitted to the Presbyterian Hospital, June 1, 1925. She had always been well until five years ago, when she began to have nausea and vomiting spells after hard work. Three years ago she noticed abdominal swelling, first in loins; walking has been an effort for the past year; no pain; enormous appetite but no indigestion; bowels regular; urination normal; menses regular until three years ago, then some irregularity for one year and no menses for past two years. Two years ago, she weighed 142 pounds; usual weight 137 pounds; she weighed 237 pounds at time of

admittance, although her face and limbs had been losing weight since she had influenza nearly two years before.

The patient was a thin, poorly developed and poorly nourished woman with emaciated, drawn face. She had to be propped up in bed. The most prominent feature was an immense protrusion of the abdominal wall which was symmetrical and smooth, with skin very tense. The swelling began posteriorly in both flanks and extended far anteriorly. The circumference at the umbilicus was 63 inches, and from the sternoxiphoid joint to the symphysis pubis measured 36 inches.

There was a marked fluid wave within the tumor; percussion note over entire dome was dull. None of the intraabdominal organs were palpable. Peristalsis was sluggish. The veins passing over the dome of the tumor were flattened or depressed. The cervical vessels pulsated visibly. The chest showed limited symmetrical and equal expansion; thoracic type of breathing. There was no diminution of the percussion note. Sounds were well transmitted, with no rales or adventitious sounds. Apex beat in left fifth intercostal space. Rate, normal; rhythm, good; apex beat, soft; no shock or thrill. No enlargement of cardiac dullness was noted. No murmurs. Marked edema in both legs, especially along tibia and about the ankles. No cyanosis; no edema of face.

Blood pressure 154/106; urine normal; P. S. P. 15-5 20; blood count: Hg, 76 per cent; R. B. C., 3,820,000; W. B. C., 6,800.

June 5, 1925: The patient had to be held in a sitting position on the operating table and the enormous abdomen supported on both sides.

Incision: Midline below and up to umbilicus. Adhesions of the cyst to abdominal wall, slight in extent, were broken down by the hand. Cyst was punctured with trocar. As much of the fluid as possible was drawn off into receptacles, but part escaped into the abdominal cavity and onto the floor. It was of a seromucous consistency and light brown color, fairly clear. After a great part of the fluid had been withdrawn, the cyst was removed from the abdomen. It was found to be attached to the left ovary by a pedicle 2 or 3 inches long and only one-half an inch thick, which was twisted. Pedicle was ligated and cut, and cyst removed. Right ovary was then removed by ligation of mesovarium.

During the operation which lasted forty-five minutes, the blood pressure was at the start 135/90; during freeing of adhesions 145/90; during tapping it dropped to 120/70, then 110/60; upon removal of cyst and traction upon pedicle 70/40, then 60/0. An intravenous saline infusion with adrenalin was given and the pressure became 75/0 then 160/100, and after dressing and removal to bed, 110/70. The pulse rate was 90 at start of operation; 105 until intravenous solution was given, when it rose to 115 and was 120 when she was removed to bed in unusually good condition, considering that the temperature in the operating room was 107° during the operation.

After closing the abdomen with interrupted silkworm gut sutures, the most unusual appearance presented itself as the lower ribs had been so distended and the abdominal wall so relaxed that it fell flat against the spine and looked like a curtain of skin covering the diaphragm. The heart beat was distinctly visible. This depression was packed with sixteen ordinary-sized laparotomy pads bound tightly with broad adhesive strips.

She made an unusually uncomplicated, easy, and rapid recovery. Broad adhesive bands were put around the lower ribs and these were tightened every day. She was kept in bed for twenty-six days and went home on July 7 in good condition, weighing 116 pounds. A report from her, dated March 1, says, "I never felt better in my life and now weigh 138 pounds."

The cyst and contained fluid weighed 122 pounds, the fluid measuring 52 quarts. Specimen measured 51 by 48 by 43 cm., with numerous broken up adhesions. It was unilocular. Thickness of the wall varied from 1 to 4 mm. In the thickened

part, the wall showed externally, dirty greenish discoloration over an area roughly 33 by 31 cm. Over this greenish discoloration area there was hyaline-like material adherent to the surface. The pedicle was very thin, measuring only 9 mm. in diameter. The tube was stretched over the cyst, and measured 21 by 5 mm.

In the broad ligament there was a fusiform thickening, measuring 5 by 1.5 by 1 cm. and resembling ovarian tissue.

At a point 14 cm. from the fimbriated end of the tube there was imbedded in the wall of the cyst, an irregular, nodular solid tumor mass, which measured 20 by 19 by 6 cm. It was polycystic, with irregular areas between the cysts.

Histologic examination showed in the thick portion of the wall papilliferous cystadenoma which had undergone carcinomatous degeneration.

The points of interest seem to be the unusually large size and weight of the cyst (in a brief review of the literature only nine cases larger could be found); the comparatively slight symptoms and discomfort before operation; the reactions during operation, especially during such a high temperature, and the very easy recovery.

#### DISCUSSION ON THE JOINT REPORTS

DR. PHILIP F. WILLIAMS asked about the condition of the opposite ovary in these cases of primary carcinoma and sarcoma of the ovary.

DR. JOHN A. MCGLINN said that the incidence of recurrence in the opposite ovary was rather high in his experience. He had had two or three cases of apparently normal ovary, particularly in sarcoma, followed by recurrence on the other side.

DR. B. MANN stated that in his case the opposite tube and ovary were normal in size. The uterus was slightly enlarged. The uterus, tube, and ovary were all markedly injected. The condition of the patient at the operation was such, on account of the severe hemorrhage and asthenia, that it was necessary to finish as quickly as possible; therefore, the uterus was not removed.

DR. LEWIS C. SCHEFFEY said that in his case the opposite ovary was apparently normal, and it was not removed.

DR. DAVID L. BELDING, of Boston, by invitation, read a paper entitled **The Effect of Treatment of Syphilitic Pregnant Women Upon the Incidence of Congenital Syphilis.** (For original article see page 839.)

#### DISCUSSION

DR. JOHN A. KOLMER said that in his opinion the excellent statistical analysis presented by Dr. Belding confirmed our general knowledge of the importance of congenital syphilis although he did not share his somewhat pessimistic opinion of the influence of specific treatment of the expectant syphilitic mother during pregnancy. The mere fact that syphilitic women may bring forth almost as many living children as nonsyphilitic women is not acceptable evidence that the children of the former have escaped contracting the disease. The clinical diagnosis of latent congenital syphilis is frequently a very difficult problem, calling for the cooperation of not only the serologist but likewise of the roentgenologist and other specialists. In other words the incidence of congenital syphilis is higher than that indicated by the Wassermann test alone and he knew from experience that this test frequently yielded falsely negative reactions in cases of clinically latent congenital syphilis. Dr. Kolmer claimed, however, with pardonable pride, that his own complement-fixation test based upon studies on the standardization of the Wassermann reaction, detected a much larger percentage of these cases than the ordinary Wassermann method. He believed the same could be said of the Kahn precipitation test and in his experience

the serum diagnosis of congenital syphilis is best served by using both tests with the serum of mother and child.

Dr. Kolmer believed that the thorough and proper treatment of the syphilitic woman during pregnancy has proved to be an efficient, sensible, and practical method for preventing prenatal infection of the unborn and particularly if the woman has been infected within five years of her pregnancy. If her syphilitic infection is of longer duration, she may give birth to a nonsyphilitic child, provided nothing has occurred during her pregnancy to stir up the latent infection. But even under these circumstances great care is required in the serologic and clinical examination of the child before one is warranted in expressing the opinion that the child has apparently escaped infection. Dr. Kolmer believed it a wise and sound practice to administer antisyphilitic treatment to every syphilitic woman during pregnancy, regardless of the question of the clinical latency of her disease. It must be stated, however, that the treatment of chronic latent syphilis in the expectant mother presents certain problems and that the choice of drugs and their administration should be such as to reduce to a minimum the chances of producing Herxheimer exacerbations and the possibility of transmission of the disease to the fetus.

In practice one of the most difficult problems is to handle a woman during pregnancy when syphilis is discovered in the father. In other words it is frequently difficult to decide whether or not the expectant mother should be treated and if so, how this should be done, without informing her of the nature of the treatment, in order to preserve domestic peace and happiness. However, this usually can and should be done rather than deprive the unborn child of a chance to escape infection by proper treatment of its mother.

In Dr. Kolmer's opinion the birth of a child with syphilis may be accepted as evidence that the mother is likewise syphilitic even though her Wassermann test yields a negative reaction and even though she presents no clinical evidences of the disease. It is now quite well established that pregnancy results in an increase of immunity to syphilis which may afford much more protection to the mother against the disease than is the case in syphilis of men and nonchildbearing women, but the disease may be nevertheless present; and he felt that the mother of a syphilitic child should always receive appropriate treatment for the disease.

Dr. Kolmer entertained a very high opinion of the specificity of the Wassermann test for syphilis in this country, where frambesia is practically unknown. He is likewise impressed with the great value of cholesterolized antigens, but admits that they may sometimes yield a nonspecific reaction unless used in the proper dosage and in a proper manner. His own complement-fixation test does not yield nonspecific reactions and there is no fear of obtaining such in tests with the sera of nonsyphilitic pregnant women. In his experience a positive reaction in pregnancy with this test may be safely accepted as evidence of syphilis and this refers not only to the strongly positive reactions but to the weakly positive reactions as well. Indeed the danger is not from the standpoint of securing nonspecific positive reactions but rather from the question of falsely negative reactions. The serum test for syphilis is not yet capable of detecting all cases and in his opinion never will be, since the disease may be so latent that there is not enough antibody present in the blood to enable its detection in the test tube.

Dr. Kolmer did not find the sera of pregnant women to be more anticomplementary in his test than the sera of nonpregnant women, but placental cord blood is usually more anticomplementary.

DR. JOSEPH V. KLAUDER said that conditions which modify the transmission of syphilis include the duration of the disease in the parents, whether the mother alone is infected, or the father primarily infected, or both parents are infected. If the infection is recent in both parents and is untreated, the transmission of syphilis is certain. In these instances Kassowitz' law is invariably fulfilled, the

first conception resulting in a miscarriage, followed by a stillborn child, then by a child that lives only a short time; later children are born who soon present the clinical manifestations of syphilis. The longer the infection in the parents, the less disastrous the results with reference to the transmission of the disease. Then comes a time in which the disease is not transmitted to the progeny. It is thought that after eight, ten, or twelve years the disease is not transmitted. Of course treatment modifies the transmission of syphilis. Considering the aforementioned, the variable picture of a familial study is explained.

Dr. Klauder agreed with Dr. Belding and Dr. Kolmer about possible fallacy of the positive cord Wassermann. The obtaining of a positive Wassermann from the cord may be analogous to injecting four-plus Wassermann serum into the vein of a dog and immediately thereafter performing the Wassermann test on the blood of the same dog withdrawn from a different vein. In other words, the substances producing a positive Wassermann in the cord blood may be elaborated in the mother and not necessarily in the newborn child. Of course subsequent Wassermann tests performed with the blood of the newborn would eliminate this possible fallacy.

The transmission of syphilis is a matter of vital importance to the obstetrician and Dr. Klauder even said that it is incumbent for the obstetrician to become a syphilologist, in order to become familiar with the clinical manifestations of syphilis and the ever-changing therapy of the disease. The obstetric clinic and syphilitic clinic should closely cooperate. Perhaps the ideal plan would be to have part of both clinics merge into one, thereby facilitating cooperation, conferences, consultations, therapy and follow-up of the patient.

In recently infected women, conception should be delayed until the Wassermann becomes negative as a result of treatment. To obtain a negative Wassermann in these cases is not difficult. However, in patients not recently infected, to obtain a negative Wassermann is sometimes very difficult.

Bismuth was in many cases a better suited drug for the obstetrician to employ than the arsenicals. In many ways it is safer and at the same time very effective. After its use one does not experience the severe untoward reactions as after the arsenicals. The fact that it is given intramuscularly has much in its favor. Its therapeutic value is greater than mercury, approaching that of the arsenicals, without many of the latter's disadvantages.

DR. KNIPE said he would like to know what should be told to a man, known to be or have been syphilitic, about to be married.

DR. KOLMER said that it is very difficult to pass upon the question of the curability of syphilis but his present criteria in relation to candidates for marriage are as follows: (a) Complete absence of all clinical manifestations; (b) a series of negative Wassermann reactions over a period of two years with a test combining the maximum degree of sensitiveness with specificity; (c) at least one examination of the cerebrospinal fluid with a normal number of cells, no increase of protein, a negative colloidal gold reaction, and a negative Wassermann reaction.

When the Wassermann reaction is employed as one of the criteria of cure it is particularly imperative that the method shall be one combining the maximum degree of sensitiveness with specificity. Great harm is being done at present by guiding the treatment of syphilis by a Wassermann test lacking in sensitiveness because this may mean the administration of insufficient treatment.

Dr. Kolmer believed it particularly important to apply rigid criteria in the case of a syphilitic woman approaching marriage because she is more likely to transmit the disease to the offspring than is a syphilitic male. In every case there should be an absolute minimum of treatment regardless of the results of serum tests.

DR. BELDING said that it should be clearly understood that these tests were made with the old style cholesterolized antigen before Dr. Kolmer's present technic had been perfected. Technical errors may give rise to false negative as well as to false positive reactions in the pregnant woman. He had had little experience with the Kahn test in the pregnant woman. Dr. W. A. Hinton, of the Massachusetts Department of Public Health, has found the Kahn test rather unsatisfactory in pregnancy. He (Dr. B.) found the Kahn test highly satisfactory as a check on routine Wassermann tests. In patients under treatment, the Kahn reaction apparently remains positive longer than the Wassermann reaction. Dr. Belding was favorably impressed with bismuth, particularly in the treatment of arsphenamine-fast patients. It represents an additional drug for the syphilologist, which is especially advantageous when frequent change of remedy is desirable. There is no reason why it should not be used during pregnancy if due precautions are taken in regard to dosage.

In interpreting the statistics presented this evening it should be remembered that both the treated and untreated groups are composed of serum positive syphilitic women, only part of whom show evidence of clinical syphilis; that old and inactive syphilis in the mother does not have as injurious an effect on the child as recent active syphilis; and that the treated women received insufficient treatment according to present-day standards; therefore the effect of treatment is less striking. The clinical composition and previous history indicate that the treated group is more seriously afflicted with syphilis than the untreated group, and that it is more nearly comparable to that section of the untreated group which include women with a history of clinical syphilis. A comparison of the two groups shows that the treated women have 1.6 times as many living nonsyphilitic children as the untreated women with clinical syphilis and that the difference lies chiefly in the fetal death rate.

The determination of the presence of congenital syphilis in children, as brought out by Dr. Kolmer, is especially difficult. Dr. Belding classed as nonsyphilitic all children under four years of age in whom careful physical and serologic examination has not revealed the presence of syphilis. Unquestionably children with latent syphilitic infection have been overlooked.

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## NEW ORLEANS GYNECOLOGICAL AND OBSTETRICAL SOCIETY

MEETING OF MARCH 10, 1926

DR. MAURICE J. GELPI reported a case of **Hydrosalpinx with B. Coli Infection.**

This case was presented to elicit discussion as to the possible origin of the infection and the wisdom of the conservatism adopted in handling it. This patient was believed to have had pyelitis, of colon bacillus origin, almost from babyhood, and she continued delicate, with recurring attacks of the supposed trouble, until she was old enough to be given kidney lavage, when she improved somewhat, although even then she remained so delicate that tuberculosis was always considered a definite possibility with her. The pyelitis, however, did clear up. Almost as soon as she was married she began to have pelvic trouble. Her first period after marriage was regular, following which time she did not menstruate for six weeks. Then intermittent bleeding began, the pelvic pain getting more and more annoying and finally localizing to the right side. I found an apparently cystic mass on that side, which I considered strongly suggestive of an ectopic, in view of the

history. Under rest and observation the mass increased in size, and I therefore advised operation under local anesthesia, to which she agreed. Laparotomy showed a very ugly appendix, and instead of the one cystic mass, which I had made out on examination, bilateral masses were found, adherent in every direction, and extending down to the rectum. They were definitely hydrosalpinges. Aspirating as a routine, although I did not expect a positive culture, I found colon bacillus. The question was now what to do. She was very young, anxious for children, and in view of the nonspecific character of the infection I felt justified in resecting each tube and leaving the stump *in situ*, so that I could tell her truthfully that anatomically and physiologically she could bear children. I am not, of course, very hopeful that this will come to pass.

### DISCUSSION

DR. C. JEFF MILLER.—The origin of infection in these cases is very difficult to determine, and the childhood history is sometimes of value. It is a possibility in this instance, as in others, that the infection, when the patient was a young girl, may have been of the specific type, for we know that the gonococcal strain may die out and pave the way for a mixed infection later. In this case the long-standing pyelitis seems to offer a definite entrance. I have found also that some cases giving a history of prolonged constipation will show a pure colon bacillus infection. Ascending infections are not so easily explained; the internal os, is an effective barrier against almost every organism except the gonococcus. The cavity of the uterus is usually sterile, even in the face of marked adnexal or cervical disease, and we now know that our former term "chronic endometritis" is a misnomer. Another possible avenue in this case is an old specific infection which spread upward during menstruation. Kidd, in a recent review of the subject from his large London clinic, states that if infection occurs eight or nine days before a period, extension upward is possible during menstruation, particularly if the patient remains up and active. On the other hand, such an infection may lie dormant for years and be carried up later during the trauma incident to delivery. Certainly the majority of these cases are originally specific in origin, no matter with what strain they end.

As to the matter of conservatism; in this case I think it was wise to attempt it, though I have never considered the thickness of the tubal wall as a criterion in my decision. Part of our trouble in the past is that we have not paid enough attention to the isthmic portion of the tube; pathology in that region should be a definite contraindication to conservatism.

DR. P. B. SALATICH.—The etiology of these cases is almost impossible to determine in many instances, and innumerable theories, some of them rather fantastic, have been advanced to explain it. I have been rather fortunate in conservative pelvic surgery, in one case particularly, that of a woman whose first pregnancy terminated in abortion and her second in an ectopic, without operation. She was very anxious for children, and when she came to me, I advised a long period of rest, followed by laparotomy. At operation I found the right side completely destroyed by the former ectopic, while the left tube was the site of a hydrosalpinx, containing possibly 7 oz. of fluid. The ovary was three times its normal size and cystic. I removed the left adnexa and resected the tube and ovary on the right, without much hope of a successful result, but since then that patient has had two normal deliveries.

DR. W. E. LEVY.—I am wondering whether conservative surgery in these cases opens up an avenue for subsequent interstitial pregnancy. In looking up the literature on the subject, because of a case of this sort which I had recently, I noticed that Dr. Matas in the *Transactions of the Southern Surgical Association*

for 1905, reported a case of interstitial pregnancy in the stump of a resected tube. If the fimbriated end is occluded, the isthmie end may be partially occluded also, and the ovum might be arrested there, with a resulting interstitial pregnancy.

DR. GELPI (closing).—As Dr. Miller says, the possibility of specific infection is inherent in every sort of pelvic disease and should be carefully considered. I felt in this case that it could be ignored, not only because of my knowledge of her previous history but also because of the character of the hydrosalpinx. A tube specifically infected is always thickened and that thickening remains for years, even after the primary infection disappears. Even where specific infection is only suspected, I think conservatism is unwise, for the section left harbors the infection, and you will hear from it later. In the thin-walled, nonspecific type, however, the pathology comes from pressure, and so the wall itself is not involved in the process. I agree with Dr. Levy that interstitial pregnancy at a later date is a possibility, but in a young woman who ardently desires children the risk is worth taking.

DR. E. L. KING, read a paper entitled **Intrauterine Fetal Death Due to Anomalies of the Cord.** (See page 812.)

#### DISCUSSION

DR. E. S. LEWIS.—A very interesting article on the causes of intrauterine fetal death will be found in the February issue of the **AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY**. One type of prenatal fetal death before maturity is often due to a more extensive fatty degeneration of the placenta than normally occurs even at term, with consequent impairment of function. The induction of premature labor prior to the time at which habitual death occurs in women with a history of repeated stillbirths prior to term will often result in the birth of a living child. I recall one case of stillbirth due to compression of the cord between the head and the pelvis, so high as not to be suspected. Immediately after the birth of the head a long loop of cord prolapsed beside it, and a definite area of compression was visible. The heart sounds were normal when the head engaged but ceased during the progress of labor.

DR. P. B. SALATICI.—We pay too little attention to anomalies of the cord. If the baby is alive and well we are inclined to forego routine examination of the cord, whereas if it were examined routinely at every delivery we might get some valuable information, and we would, I am sure, find many more true knots than are usually supposed to occur.

DR. HILLIARD E. MILLER.—I have seen lately a fair number of short cords and asphyxiated babies, and in three instances particularly respiration has been established with difficulty. I have been using in these cases alpha-lobelin by hypodermic, which acts promptly upon the respiratory centers of the brain.

DR. KING (closing).—I believe an occasional case of intrauterine fetal death is due, as Dr. Lewis says, to the so-called concealed prolapse of the cord. I recollect one instance several years ago, in a face presentation. When I made my examination the cord was not accessible, and the baby died long before the cervix was sufficiently dilated to permit of any sort of delivery. The patient was a primipara, with a face presentation, which was reduced to an occipital. A stillborn baby was delivered by forceps. There was a definite area of compression in the cord, and I could discover no other reason for the stillbirth. Possibly in other instances of unexplained fetal death within the uterus the cord may have prolapsed at the side of the head.



DR. E. L. KING also exhibited a specimen of papyraceous fetus, one of twins. The other twin, a full-term, normal baby, was born first. Its cord was of normal size and thickness, and the sac was unusually large. The shriveled fetus had a small, shriveled cord, and a very small sac. The placentae were separate, one being normal, the other very much degenerated. Apparently they were double ovum twins, each with a separate placenta and amnion.

DR. HILLIARD E. MILLER read a paper entitled **Curettage of the Uterus, Its Indications and Advantages.** (See page 860.)

#### DISCUSSION

DR. E. L. KING.—I wish to second Dr. Miller's warning against the use of the curette in incomplete abortions. In many articles, particularly in the French journals, this procedure is advocated, and I gather that some men curette all abortions as a routine. In our large service at Charity Hospital (Dr. C. Jeff Miller), where we get all the incomplete abortions on the white side, we have entirely discarded the curette. I don't think we use it twice a year, and we handle several hundred cases yearly. When we do use it, it is because of hyperplasia following an old, improperly handled abortion. Our routine procedure, when interference is indicated, is to clean out the uterus very gently with the finger or sponge forceps, occasionally without anesthesia, but usually under general. There are several obvious objections to the use of the curette under these circumstances. One is that the fundus of the uterus is very soft and correspondingly easy to perforate. Another is that we do not know which of these cases are criminal abortions, and potentially infected already, even if fever is not present, so that curettage may spread the local infection throughout the system. The simple cleaning out I have described is as safe as any procedure can be under the circumstances. One point not usually stressed, but which I noticed particularly in a French journal some years ago, is the importance of checking up the position of the uterus before operating. In the instance cited the patient had a retro-displaced uterus. No examination was made at the time of operation, the dilator was introduced with the curve forward, and perforation just above the internal os promptly resulted. The surgeon recognized the accident and repaired it at once, and was also brave enough to put his mistake on record.

DR. E. S. LEWIS.—I suppose I shall be classed as archaic, but I am in favor of the curette in selected instances. I can recall many times when its use was decidedly advantageous in the treatment of early abortions with continued hemorrhage due to retention of the secundines, and I cannot say that I have any regrets on that score. I believe that interference is wise as soon as it is definitely ascertained that abortion has occurred, since continued retention means continued hemorrhage and also danger of sepsis. After the placenta is fully formed, the finger makes the best curette, and can be inserted easily if interference is practiced at once. If it is deferred, dilatation of the cervix is usually necessary, as contraction occurs very rapidly. The uterus is soft and may be easily perforated in careless hands, so extreme gentleness is necessary. I have also used the curette for menorrhagia and metrorrhagia hundreds of times without accident. though of course I am referring to my early days, when this instrument was used very much more widely than it is at present. For years before I gave up obstetrics I had ceased to use the curette in puerperal infections, for in the light of our present knowledge this procedure is a dangerous and unwise one, and yet I can recall several instances in the past in which it did good. I remember one patient who had a premature delivery at six months, followed by a septic infec-

tion with a highly offensive discharge, and very high temperature. I curetted her thoroughly, gave her a carbolic intrauterine irrigation, and packed the uterus thoroughly with iodoform gauze. When I returned the next day I found her entirely free from fever, and her convalescence thereafter was without incident. The procedure is not a safe one, however, and I would no longer advocate it. In my hands, curettage for sterility has frequently resulted in pregnancy. I also agree with Dr. Miller that in many instances it will obviate the necessity for a more serious and more radical operative procedure.

DR. MILLER (closing).—The whole point of this paper was to analyze results in the cases in which we advocate curettage where others condemn it. I made no statistical study, but a casual review of our records has thoroughly satisfied me that we are justified in our stand, and that the number of radical operations we perform is decidedly less than if we were bound by the classical indications ordinarily advanced for the use of the curette.

#### MEETING OF APRIL 29, 1926

Dr. JOHN F. DICKS read a paper on **Intracranial Hemorrhage in the Newborn.** (See page 871.)

#### DISCUSSION

DR. E. L. KING.—In public hospitals, where obstetric cases are so often brought in as emergencies after neglect or bad management, we may be responsible for some cases of intracranial hemorrhage, because we frequently have to apply forceps against our better judgment, it being too late for cesarean section. Intracranial hemorrhage is so frequently found in difficult labors that spinal puncture is always indicated at once if these babies show any signs of respiratory embarrassment or irregular respiration. The cases which give me the most anxiety are those in which there is a peculiar grunting, somewhat like the expiratory grunt of pneumonia. My experience is that such babies usually die, although it is our practice to do spinal puncture on them at once. We do not always enter the canal on the first trial, I admit, but repeated attempts usually end in success, and certainly when the bloody fluid is released the change in the child's condition is most striking. In one such case we worked over the baby for more than three hours, but almost as soon as the bloody fluid was withdrawn under pressure there was no further trouble. The child a year later was apparently normal in every respect, although the ultimate outcome is, of course, still dubious. Autopsy should be done whenever possible, but the skull is usually opened the wrong way. I do not believe that a newborn infant's skull should ever be opened by sawing around the top of the head. Intracranial hemorrhage will never be detected by that method. The technic Ehrenfest describes is much the best. He advocates incising on either side of the midline, just external to the superior longitudinal sinus; anteriorly the coronal suture is cut through, posteriorly the lambdoidal suture is cut, so that the parietal bones are finally laid open with the temporo-sphenoidal suture as a hinge. Then the tentorium can be studied after the removal of the cerebral hemispheres and the interior of the skull examined.

DR. LUCIEN A. LEDOUX.—In our service we have adopted the plan of routine autopsies, and seven out of the last eight showed that death was due to intracranial hemorrhage, varying from the small petechial type to a clot the size of a hen's egg. Of these cases some could be attributed to operative delivery and some to the use of pituitrin. The obstetrician is not always to blame, for uncontrolled, precipitate labors in my opinion are responsible for a large number of

these cases. Pituitrin, however, is responsible for many more, for its use invariably causes an excessive overlapping of the cranial bones which is bound to result in injury. Spinal puncture has a diagnostic as well as a therapeutic value, and I would advocate doing it and repeating it as indicated, regardless of the type of injury.

DR. HILLIARD E. MILLER.—I take exception to the generalization that operative delivery always predisposes to intracranial hemorrhage. I believe that if more cases were interfered with earlier we should have fewer such mishaps. When there is a long, tedious labor, and particularly a prolonged second stage, you almost invariably have a malpresentation of the head or a postmature baby. Early recognition of these cases with the proper operative delivery will achieve very much better results than waiting for the head to mold. In occipitoposterior positions, where engagement does not occur after full dilatation, version and breech extraction lessen the chance of intracranial hemorrhage. The termination of a prolonged second stage by the careful application of forceps, granting, of course, that the indications warrant this procedure, will eliminate a fair percentage of these head injuries. I, personally, have had no case of intracranial hemorrhage in the last five years, and I attribute it to the fact that I am a consistent advocate of early forceps application.

DR. J. S. HEBERT.—I am in accord with Dr. Miller's remarks, for I believe that he has given the correct explanation of a large number of these accidents. Furthermore, I wish to add that when prenatal care includes, as it should, a complete physical examination and accurate pelvic measurements, many more of these unfortunate cases will be eliminated. In the management of a case with borderline pelvic diameters, for instance, the recognition of such a condition prior to the onset of labor will mean that the test of labor is conducted with proper precautions, and that operative delivery, by cesarean section if necessary, can be instituted with safety when it is evident that vaginal delivery is impossible. Careful watching of the fetal heart will also permit operative interference in time to save the child when carelessness in this regard may mean either the death of the fetus or serious brain damage.

DR. CHARLES J. BLOOM (by invitation).—I saw the first child reported by Dr. Dicks about thirty-six hours after delivery, after several convulsions, when there was a marked disinclination to nurse, protrusion of the tongue, and other definite symptoms of intracranial hemorrhage. Three spinal punctures were done, bloody fluid being recovered in successively smaller amounts, and whole blood was given subcutaneously after each puncture. The child is now about two years old, and apparently perfectly normal. She is in full possession of her mental faculties and shows none of the earmarks of spastic paralysis so often referable to this condition. Another case similar to this one was referred, after a prolonged labor. There was no external manifestation of injury, but thirty-six hours after birth the child became very pale, refused to nurse, and gave evidence of tonic convulsions. One spinal puncture, with the fluid somewhat under pressure, seemed to relieve the symptoms entirely, and twenty-four hours later the child was nursing with avidity. The second case which Dr. Dicks has reported is rather interesting. Twenty-four hours after birth fever developed, which, in view of the lack of other symptoms, we considered a possible inanition fever; this, as you know, is possible, though not probable, in a very young infant within the first thirty-six hours. The classical symptoms of intracranial hemorrhage developed shortly afterwards, however, and the fever on the third day reached a maximum of nearly 107°. There were marked opisthotonos, clonic and tonic convulsions, and irregular attacks of cyanosis. The convulsions were without periodicity and

of varying duration. I have never seen a more marked case of opisthotonos, and death seemed imminent. Two spinal punctures were done, followed by the routine subcutaneous injections of whole blood, and recovery was most gratifying. The child is now three months old and apparently normal in every respect.

From the point of view of the pediatrician, intracranial hemorrhage in the newborn is usually considered to be due to three chief factors; trauma, asphyxiation, and the so-called hemorrhagic disease of the newborn. To my mind the latter condition plays but a small part in the etiology of this condition, and I consider trauma to be the most important factor, whether it occurs as the result of precipitate labor, faulty instrumentation, or the use of pituitrin. Asphyxiation is practically always the result of the different obstetric maneuvers and therefore is really an indirect result of trauma. Regardless of the cause, it should be emphasized that it is the responsibility of all, pediatricians, obstetricians and general practitioners alike, to watch for this condition and to recognize it at birth. There are usually too many symptoms to excuse a failure to diagnose the average case. Many authorities go so far as to say that any child delivered after pituitrin or obstetric maneuvers of any kind, or by a precipitate labor, should be given the benefit of the doubt; that is, it should be subjected to the most careful observation, and spinal puncture should be done on the appearance of the slightest symptom. Dr. John Foote of Washington advocates the giving of 20 c.c. of whole blood subcutaneously after any questionable labor as a prophylactic measure. When active symptoms are present, spinal puncture should be done as soon as possible, and should be repeated every six to eight hours until the fluid assumes a normal color, whole blood being given after each puncture. In every case we have treated in the last five years by this routine the results have been most gratifying except in one instance; in this case the child has a slight shortening of the left leg, so slight, however, as to be hardly noticeable.

DR. WALTER E. LEVY read a paper entitled **The Value of Glucose and Insulin to the Obstetrician and Gynecologist.** (See page 866.)

#### DISCUSSION

DR. E. L. KING.—I have used this method particularly in the vomiting of pregnancy, and I am inclined to believe that Thalhimer is right in his contention, although I am aware that Titus considers that the addition of insulin to the glucose introduces a decided element of danger. In the vomiting of pregnancy, in the pernicious type, if vigorous use of this method does not give results within twenty-four to forty-eight hours, the case will generally demand therapeutic abortion. Possibly in the individual case the time limit might be somewhat extended, but as a general rule it would seem that if the method is to be effective, it will be effective at once. In eclampsia and pre-eclamptic toxemia I am not so sure that insulin is as effective.

DR. C. JEFF MILLER read a paper entitled **The Preventive Aspects of Postpartum Care.** (See page 856.)

#### DISCUSSION

DR. W. D. PHILLIPS.—Prenatal care in recent years has received a great deal of attention, but our watchfulness too often ends with the delivery. The condition which has given me most trouble is retrodisplacement of the uterus. A possible cause, which I have not seen mentioned very often in the literature, is too great haste and too much force in the expulsion of the placenta. Free

movement of the patient immediately after delivery is an important preventive measure. The knee-chest position is also very useful. Careful examination of the patients after delivery and also before they leave the hospital should be routine.

The final examination is particularly important when repair has been necessary, for if the sutures have not held properly and the lifting portion of the levator ani muscle has been injured, the foundation of a downward displacement of the uterus is thus laid. In connection with immediate repair of the perineum I think possibly our unsuccessful results are often due to infection of the wound from fecal material passing over it at the time of delivery.

DR. HILLIARD E. MILLER.—I make it a point to instruct each of my patients that I expect a phone call from her on the eighteenth day, for I have found that in a surprising number of cases the red lochia persist up to and beyond this period, and under the circumstances, as you know, involution is retarded. If the red discharge is persisting at this time, I give ergotine, 2 gr. twice a day for ten days, instructing the patient to continue it the full time for its tonic effect, no matter how soon the flow may cease. I order as a routine hot daily douches for ten days after the patients leave the hospital, and then two or three times a week until the final postpartum examination. If in spite of these measures the flow persists, I paint the vault of the vagina with tincture of iodine, swab out the excess with alcohol, and use ichthyol and glycerin tampons on alternate days until relief is secured. If we are careful about early subinvolution we shall see fewer cases of retroversion after parturition.

DR. WALTER E. LEVY.—I do not approve of a routine enema before delivery on the nurse's responsibility alone, for the reason that in more than one instance I have seen delivery precipitated when the enema was being expelled. It is routine on our service at Touro for the nurse to insert the rectal tube after the enema is given, so that the entire contents are expelled and the chance of contamination during labor is minimized. We also have a standing order that if a patient has not voided within eight hours after delivery, the nurse need not wait for an order to use the catheter, if the simpler measures to induce voiding have failed. A full bladder is responsible, in my opinion, for many cases of postpartum hemorrhage, for as the bladder rises, it drags the uterus up with it. Furthermore, a full bladder can force a uterus into retroversion, and retention of the lochia will result.

DR. MILLER (closing).—I have seen patients frequently complain of abdominal cramps after cauterization when the treatment was extended up to the internal os, and for that reason, when I feel that cauterization is necessary to the upper limit of the cervix, I advise that it be done under anesthesia. The best effect of cauterization for the ordinary erosions is secured within two to four months after delivery, and even when a fair degree of laceration is present this procedure is remarkably effective. The infection, of course, rather than the laceration is the important factor, and too much stress cannot be laid upon clearing up these conditions. To me the simplest method of treating a retroverted uterus following delivery is the insertion of a Smith or Hodge pessary, which takes the weight off the ligaments; it must be realized that if the uterus sinks below a certain level in the pelvis, disturbances of circulation are bound to result. The pessary has its widest field of application here, and provided the pelvic floor is in good condition, it will avert a very fair percentage of subsequent suspension operations. I cannot agree with the men who advise against the repair of lacerations in the childbearing period. I have seen many of these patients, when that period was past, with large, hyperplastic uteri, cystoceles, rectoceles and intractable bladder symptoms.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Selected Abstracts

### Uterine Malpositions

Von Jaschke: The Import and Value of General Symptoms in Retroversion and Retroflexion of the Uterus. *Zentralblatt für Gynäkologie*, 1925, xlix, 189.

The writer believes that general symptoms are rarely a result of alteration in the position of the uterus, either directly or reflexly; nor are they to be described as a psychoneurosis. In nulliparas the underlying cause of symptoms is usually a general enteroptosis. Even with definite enteroptosis in normal women localized complications with resultant alteration of structure and function is an important factor. There is no general rule for operability. LITTLE.

Meyer-Ruegg, H.: On Retroflexion of the Uterus. *Schweizerische medizinische Wochenschrift*, 1923, liii, 34.

Retroflexion is assigned by physicians as one of the common causes for numerous disturbances in the female organism. It has occupied a place of importance as a causative factor because of the mental attitude towards its significance as a disturbing element. The fairest way is to consider retroflexion merely as one of the various positions of the uterus, anomalous or otherwise, and treat it intrinsically as such. Of itself, the discovery of retroflexion in examination does not mean it must be corrected except in certain instances, for example: cases of sterility where all other factors have been eliminated; where there is possibility of incarceration in pregnancy beyond the fourth month; if the uterus has prolapsed to the pelvic floor or is at the genital hiatus, or when all other measures have failed, and operative correction may have a beneficial psychic effect on the patient.

A. C. WILLIAMSON.

Donald, Archibald: Treatment of Mobile Backward Displacement of the Uterus. *British Medical Journal*, 1924, ii, 1087.

"A retroverted, a retroflexed, anteverted or anteflexed, or laterally displaced womb does not cause pain, disorder, or disability." That retroversion sometimes may be accompanied by lumbar ache, aching hips, aching in the groins, thighs and so forth, is admitted, but no mention is made of menorrhagia, leucorrhea, or dysmenorrhea.

In regard to the view that passive congestion is the cause of various symptoms the writer makes the following objections: (1) Bluish discoloration of the uterus could be expected, a condition which is never found. (2) Arrangement of circulation in broad ligament would make congestion difficult. (3) No evidence of congestion is seen in severe prolapse, where it might be expected, if anywhere. (4) No dilatation of veins is seen on microscopic examination. (5) If hemorrhage is due to venous obstruction, oozing would be of the venous type, but the menorrhagia is the same in retroverted as in the anteverted uterus. (6) Leucorrhea must mean

increased activity of glands, but does congestion cause an increased activity of gland?

Treatment is required only by coexisting complications. Ninety per cent who consult a doctor do so because of menorrhagia, metrorrhagia, leucorrhea or dysmenorrhea. These disorders are regarded as due to endometritis or chronic metritis and are treated by curettage. By curettage 88 per cent are improved.

Treatment with pessaries probably has only suggestive effect, but in cases of prolapse it relieves the bearing down sensation.

Mere suspension yields poor results in the presence of adhesions or weak abdominal walls, and does not relieve dysmenorrhea, metrorrhagia, leucorrhea, etc. The only type of suspensory operation the writer uses is ventrosuspension or suture of the anterior uterine wall just above the external os to the anterior abdominal wall without removing the peritoneum.

ADAIR AND RICE.

**Michailov: The Importance of Constitutional Conditions in the Etiology of Genital Prolapse in Woman.** Russian Clinic, 1924, i, 427.

The two main factors in the causation of prolapse are (1) multiple labors and heavy work, and (2) a definite predisposition of tissues to lose easily their natural turgescence. In those women in whom this second factor evidently represents the main causative factor of an existing prolapse the author was able to ascertain as characteristic external features: a narrow chest, a sharp epigastric angle, and a long distance between the lower end of the sternum and the navel. He applies to this type of women the term "gothic style." It was distinct in 30 per cent of the cases studied. The writer stresses the importance of this peculiar habitus for the purpose of preventing the development of a prolapse in women of the gothic style.

AUTHOR'S ABSTRACT.

**Novak: The Vaginal Pessary: Its Indications and Limitations.** Journal American Medical Association, 1923, lxxx, 1294.

The indications for the use of the vaginal pessary are taken up under separate headings and each group elucidated by the quotation of statistics or case reports. The various types of pessary represented in illustrations are ideally selected to fit the individual case. In discussing the contraindications, precautions, and dangers of pessaries, Novak brings out important diagnostic and therapeutic suggestions.

W. KERWIN.

**Hofmeier: The Operative Treatment of Retroposition of the Uterus.** Zeitschrift für Geburtshilfe und Gynäkologie, 1923, lxxxvi, 509.

The author cites results obtained in approximately 800 ventrofixation operations. One hundred and sixty-three operations were for movable retroversion, 393 for fixed retroposition with or without adnexal masses, and 244 for descensus and prolapse in conjunction with other plastic operations. There were two deaths during the hospital stay in this series, both were in severely complicated cases. In the one, a large ovarian tumor was associated with an extensive prolapse; in the other, extremely dense adhesions were present in the culdesac, probably the result of a periproctitis. The first patient died of embolism on the sixth day; the second, of peritonitis on the fourth.

Patients with movable retroversions were operated upon only when they gave symptoms definitely ascribable to the retroversion, and could not be cured by simpler measures. In retroversions complicated by inflammatory processes, the symptoms are usually attributable chiefly to the latter, and operation is indicated unless simpler measures give very prompt relief. Schauta's interposition is such a satisfactory

operation in the treatment of prolapse that ventrofixation is employed only in younger women in whom the reproductive activity must be preserved.

The technic is essentially that of Olshausen. In the simpler cases the Pfannenstiel incision is used; in more complicated cases, the midline longitudinal adhesions are separated, and severely diseased adnexa removed. The ligaments are fixed into the fascia of the abdominal wall from 1 to 5 cm. from their uterine attachment. The lower portion of the peritoneal wound is closed with two catgut sutures which are taken through the anterior surface of the uterus, not through its fundus. Careful attention to this latter point and to the mere approximation of peritoneal surfaces account for the fact that, in a considerable series of later pregnancies and labors, serious difficulty was encountered in only one case.

One hundred and thirty patients operated upon from two to ten years previously were reexamined, and perfect orthopedic results were found in 85.3 per cent. Of 134 other patients, who answered the questionnaire, the result was good in 95 per cent. The functional result, which is not always the same as the anatomic, was perfect in 80.1 per cent of patients, both in regard to general health, and to capacity for work.

Of these 264 women, 80 became pregnant; 51 women, once; 20, twice; 7, three times, and 2, four times. In addition, there were observed in the clinic 25 deliveries of patients operated upon elsewhere, a total of 145 pregnancies. Of these, 110 delivered spontaneously, 8 by forceps, 9 had versions for transverse presentations. There were two premature labors, one extrauterine pregnancy, 14 abortions, and one cesarean section. In this case section was necessary because of entire lack of development of the lower uterine segment with marked upward displacement of the cervix, due to the dense adhesions at the fixation site. In spite of an attempt at careful peritonization, the same condition recurred in the next pregnancy, necessitating a repetition of the cesarean.

MARGARET SCHULZE.

Von Jaschke: Genital Prolapse in the Light of Constitutional Pathology. *Archiv fuer Gynaekologie*, 1923, cxx, 56.

In a series of 490 cases of genital prolapse, 447 showed definite signs of constitutional anomalies. The author believes, therefore, that the general conception of prolapse must be changed. The dispute as to the rôle of connective tissue and the musculature, and the comparative importance of connective tissue ligaments as against the muscle supporting apparatus loses all its value. The author still believes that in a normal woman, injury of the muscle-supporting apparatus is more important in the development of prolapse than any injury to the connective tissue suspensory apparatus. Recent experiences, however, teach that it is usually due to an inferiority of the whole organism and is often the most striking stigma of a constitutional anomaly. The most common constitutional anomalies are asthenia, infantilism, or a mixture of the two.

RALPH A. REIS.

Zimmerman: Evaluation of the Operations for Correction of the Position of the Uterus. *Zeitschrift für Geburtshilfe und Gynäkologie*, 1923, lxxxvi, 536.

The author reports results obtained in the treatment of 1035 cases of retroposition. There were 278 fixed retropositions and 757 mobile ones. Of the latter group, 582 (70 per cent) were treated conservatively, and 175 (30 per cent) operatively. Of the 278 fixed retropositions, 62 (28 per cent) were treated conservatively and 216 (72 per cent) were operated.

There were no deaths in the 386 operations. The types of operation employed were the Alexander-Adams in cases of movable retroversion without complications (118 cases), the Olshausen (132 cases), or the Baldy-Webster (59 cases). Where complications necessitated laparotomy the Leopold-Czerny, or ventrofixation (65 cases),



in women no longer capable of becoming pregnant; and in 12 cases intraperitoneal shortening of the round ligaments by plication. The results were satisfactory in all types of operation except the Baldy-Webster where, though the immediate results were very good, later examination showed 25 to 30 per cent of recurrences. This operation has, therefore, been discarded. Results with the other types of operation, though good, are still capable of improvement, but improvement should be sought in more careful determination of indications, and attention to details of technic rather than in a multiplication of operative procedures.

MARGARET SCHULZE.

Don, A., and Don, V.: Pelvic Hernia (Prolapse): The Proper Use of Pessaries and a New Method of Closing the Opening. The Clinical Journal (London), June 6, 1923, page 265.

The levators are the important components which must be carefully secured and used as buttresses just as are the recti in abdominal hernia, if an effective closure is to result. Pessaries at best are makeshift and to be useful should take their supports from the sides of the genital hiatus and not from the rectum or pubes; hence, the Zwanke type is the most scientific. Where repair has been decided upon the patient should be given sufficient time and rest after delivery for the muscles to have regained their elasticity and for the parts to have come as near back to normal as they will. During operation hemostasis is carefully carried out. The levators are well exposed. Beginning posteriorly a continuous suture of fine catgut is introduced, coming down and picking up fascia and finally muscle. Figure eight silk-worm suture is next introduced and last of all the vaginal flap is trimmed and sewed down.

A. C. WILLIAMSON.

Robinson, Wm.: On Hernia through the Outlet of the Pelvic Diaphragm in Women (Prolapse of the Uterus) and Its Radical Cure. The Clinical Journal (London), Jan. 1, 1926, p. 1.

In discussing the condition the function of the muscle fibers connecting the two adjacent sides of the puborectalis is especially stressed. Prolapse of the bladder, vagina, uterus and occasionally of the rectum through the outlet of the pelvic diaphragm results from: 1. Damage during labor to the puborectalis by the overstretching of the ring and the rupture of its connecting fibers. If the child's head is forcibly pulled through by forceps before it has passed through the cervix, the latter is also dragged down and the uterosacral ligaments are overstretched, apart from the increased risk of damage to the ring and its connecting fibers by this wrong procedure. 2. When the ring in the pelvic diaphragm is thus overstretched the intra-abdominal and intrapelvic pressure which is more or less constantly exerted, and which is increased by hard work, causes overstretching also of the uterosacral and transverse cervical ligaments. An almost constantly loaded rectum, by pushing the cervix forward and inducing prolonged straining at stool, also helps materially to cause a gliding hernia of the pelvic organs through the ring in the diaphragm.

For cystocele, an anterior colporrhaphy is advised. The bladder pouch is well freed from vagina and uterus and pushed upward and the edges of the vaginal wound and the underlying muscle tissue are stitched together from side to side. If the cervix is badly lacerated or much enlarged it is amputated, care being taken that the cervical and uterine cavity be left three inches long to guard against miscarriage.

In women past the menopause the uterus occasionally may be interposed, and in old women where the uterus is atrophied it may be removed and the broad ligament stitched together. In old unmarried women who are frail, Le Fort's operation is employed.

For relaxed pelvic outlet with or without rectocele the careful dissection of muscle is carried out, and just at the close a purse string suture is passed through the skin

at the upper end of the incision on one side down through the submucous flap and out of the skin at the other edge of the wound, so that when the suture is pulled up tightly the valvular action of the outlet of the vagina is restored. The author claims successful results in more than two hundred cases.

A. C. WILLIAMSON.

Miles, Lee Monroe: *Pelvic Hernia. Surgery, Gynecology and Obstetrics*, 1926, xlii, 482.

A new classification embracing all hernias occurring through the pelvic floor is offered, following the general usage of terminology and classifying them according to their course thus: a pelvic hernia may be perineal, pudendal, or vaginal, and a vaginal pelvic hernia may be anterior or posterior. Prolapse of the uterus accompanied by a general enlargement of the culdesac and protrusion of abdominal contents into the vaginal vault should be called either clytrocele or vaginal enterocele, and not a hernia.

The literature on the subject is reviewed and nine cases which appeared to be definitely of this order are described together with two additional cases seen by the author.

The cause of these hernias is with one exception found to be traumatic, following pregnancy or childbearing.

The treatment is operative, and the best operation is a perineal operation, by which the sac is excised and the perineum is repaired, combined with an abdominal operation for obliterating the culdesac.

WM. C. HENSKE.

Duehrssen, A.: *A Contribution to the Priority and Technic of a Well-Known Gynecologic Vaginal Operation. Archiv fuer Gynaekologie*, 1925, exxiii, 452.

Duehrssen quotes at length the article by Hastrup in which the latter claims that neither Schauta nor Wertheim nor Watkins should be given credit for the "Interposition" operation. Both Schauta and Wertheim first described their operation in 1899, whereas Duehrssen had performed this operation at least five years earlier and had described technic and results in detail in 1894. He had even coined the term "interposition" for this operation and it can be found in the original article. Since procedure and technic of Schauta, Wertheim, and Watkins differ only in details from this original operation, it is a mistake to associate the names of any or all of them with this operation. It should be called the "Duehrssen Interposition Operation."

The author also proves his priority in the so-called paravaginal incision of Schuchardt and in the method of sterilization which is usually credited to Deutzmann and Sellheim.

RALPH A. REIS.

Johnson, Frederick W.: *End-Result in the Interposition Operation for the Cure of Prolapsus Uteri and Cystocele. Surgery, Gynecology and Obstetrics*, 1926, xlii, 527.

The interposition operation, described by the late Thomas J. Watkins of Chicago, is the foundation on which the author has built, but his operation differs from any other in that the whole anterior surface of the uterus down to the cervix is sewed to the fascia of the anterior vaginal wall. Thus the uterus is firmly fixed in anteversion to the fascia, the bladder resting on the posterior aspect of the body of the uterus.

In the series of 50 patients reported, the oldest patient was sixty-nine, the youngest, thirty. It was found necessary to repair or amputate the cervix in 41 cases and Crossen's or Bandler's operation for relaxed pelvic outlet and rectocele was done in 45 cases. The mortality was nil.

To the follow-up questionnaires 32 patients replied. It appeared that 27 out of the 32 had been wholly relieved of the troubles complained of at the time of operations; there had been no falling down of the parts and there had been improvement in general health. Two got partial relief. There was a total failure in 3 cases. These were cases of enteroceles that had been overlooked on account of the large rectoceles.

Urinary pathology should be cleared up before operations. A diet that produces no accumulation of feces in the rectum should be given for seven days. Bowels are not emptied for the first seven days so that contamination of the perineal sutures may be prevented.

WM. C. HENSKE.

Recasens, Luis: Method of Thorning for Treatment of Prolapse of the Uterus.

Revista Espanola de Obstetricia y Ginecologia, 1925, vii, 281.

No operation yet described is satisfactory for curing prolapse of the uterus, and permitting future pregnancies and labors without almost inevitable recurrence of the condition for which operation was originally done.

The operation of Thorning described below has been done by the author in eight cases, with good immediate results. If done at or after the menopause it is most satisfactory, in that artificial sterilization is not necessary. The steps are as follows: 1. Pfannenstiel incision, transverse incision of fascia, retraction of recti, vertical incision through peritoneum. 2. Suture of round ligaments to parietal peritoneum by continuous suture, beginning at outer end on one side, across face of uterus, and continuing to the entrance of the other ligament into inguinal canal. (This avoids possibility of strangulation of the gut.) 3. Sterilization, if necessary, by means of excision of 1 to 2 cm. of each tube by thermocautery. (Thorning implants infundibulum of tube into anterior leaf of broad ligament for future "undoing" if occasion arises.) 4. Suture of peritoneum from above downward to posterior surface of fundus, also of recti to same point. 5. A tongue of fascia is cut from the upper edge in midline, two to two and a half cm. long and one to one and a half cm. broad, to be carried through a corresponding slit cut through the top of the fundus, and the corresponding edge of the fascia below. 6. Suture of remaining fascia and skin.

This method brings the fundus uteri extraperitoneal and secures a firm fixation. Any other required plastic operation on the cervix, vagina or perineum may be done before laparotomy.

THOS. R. GOETHALS.

Markow, N: Fixation of Uterus in Case of Prolapse. Russian Clinic, 1925, iii, 619.

The writer proposes the following modification of the Goebell-Stoeckel operation for cases of marked prolapse: A flap is dissected off alongside the abdominal incision, comprising both aponeurosis and muscle. The flap is split lengthwise, crossed at the symphysis and then on either side of the incision, one-half of it passed through aponeurosis, muscle and peritoneum, furthermore through broad ligament underneath ligamentum ovaricum, and after one more crossing is fastened to the posterior surface of the uterus. As a routine a perineal plastic is added. The fascial strips should hold the uterus firmly against the symphysis.

AUTHOR'S ABSTRACT.

Dujarier and Larget: Operative Technic of Total Colpectomy in Prolapse of Old Women. Journal de Chirurgie, 1925, xxv, 283.

Total colpectomy or Müller's operation is intended to cure complete prolapse in women past the menopause and where coitus is no longer desired. The technic as practiced by Dujarier and Larget is as follows:

*Preoperative Preparation.*—In complete prolapse the common traumatic ulcerations of the vaginal walls should be cleared up by cleansing douches and reduction of the prolapse by tamponade.

*Anesthesia.*—Spinal anesthesia is the procedure of choice, those authors using 6 to 8 cg. of novocaine intraspinally.

*Operation.*—The cervix is grasped with a tenaculum and outward traction is exerted. An incision through the vaginal mucosa is made completely around the vagina, just below the external urethral meatus and within the posterior fourchette. Two incisions, one anterior and one posterior and at right angles to the first incision are next made, and the entire vaginal wall is dissected downward to the cervix in two lateral flaps. These flaps are next cut from the cervix so that practically all of the vaginal mucosa has been removed. The cervix is then split and amputated at the desired height. All bleeding points are ligated, the remaining portion of the cervix is sutured by interrupted catgut sutures, and a small drain is left in place. The denuded anterior and posterior vaginal walls are next brought together by several layers of interrupted catgut sutures beginning at the cervix and working outward in such a way that each layer of sutures raises the uterus higher into the pelvic cavity. Finally the remaining ring of vaginal membrane is sutured anteroposteriorly.

*Postoperative Treatment.*—The vulva should be washed with sterile water twice a day. Catheterization is advisable for the first forty-eight hours to prevent contamination. The drain is removed between the tenth and twelfth day and the patient may sit up on the fifteenth day after operation.

Dujarier and Larget have performed this operation fifteen times. With the exception of one case, which was not drained and in which there developed an infected hematoma, the results have been excellent. Examining these patients two years after operation one finds the vagina replaced by a firm fibrous cord, which in all cases has proved to be of sufficient strength to withstand the intraabdominal pressure.

THEODORE W. ADAMS.

Roberts, C. S. Lane: Acute Puerperal Inversion of the Uterus. *British Medical Journal*, 1923, i, 557.

Two cases of puerperal inversion are recorded.

In the first case the outcome would certainly have been fatal had it not been possible to do immediate blood transfusion. The patient was deeply shocked and attempts at replacement of the uterus apparently only deepened the shock. The ideal treatment would appear to be immediate blood transfusion with later replacement of the uterus. If blood is not available it would be worth while to try gum acacia solution, but saline seems useless if not harmful in certain cases.

The second case falls more into line with the series published in 1920 by Dr. Spencer. The patient got up on the tenth day and seemed quite well till the sixteenth day, when during the act of defecation, she felt her womb drop; the attending physician made a diagnosis of uterine inversion.

F. L. ADAIR.

Kundu, Rajendora Nath.: Spontaneous Inversion of the Uterus. *Calcutta Medical Journal*, 1925, xx, 20.

Patient, twenty years of age, gravida ii, had a precipitate labor with a spontaneous inversion of the uterus after a little over one hour in labor. She was cold, clammy, and showed a feeble, rapid pulse. Routine method of replacement failed under anesthetic. Finally, the uterus was replaced by steady pressure with a suitable pad of gauze against the fundus. The fingers were used as a cone after the uterus started to move upwards. A hot intrauterine douche was given for ten min-

utes and the uterus plugged. Ergotine and morphine were given and the next day 20 c.c. of antistreptococcic serum was injected. The patient made an uneventful recovery. In this case the cord was not short nor the uterus in an atonic state; the author believes the inversion was due to the precipitate labor and the violent contraction of the uterus.

ADAIR AND HACKETT.

**Kamberg and Bol:** A Case of Inversion of the Uterus with Recurrence on the Tenth Day. *Nederlandsch Tijdschrift voor Geneeskunde*, 1925, i, 2141.

These authors review the incidence, possible causes, and treatment of uterine inversion and append the following case history.

A tedious labor in a twenty-two-year-old primipara was terminated by a low forceps application. The child weighed 4000 gm. While the attention of the attendant was concentrated on the child, the mother suddenly bore down and expelled the placenta. At the same time she flowed freely, became pale, and perspired freely. On examining the placenta, it was found to be adherent to the inverted uterus from which it was easily detached. The uterus was readily replaced. Bleeding was free, but was completely controlled by pituitrin and ergot. Convalescence was afebrile but the patient had difficulty in voiding urine. Ten days postpartum the patient strained in an effort to empty an overdistended bladder after which she again began to flow and to show evidence of shock. The fundus was found in the vagina inverted in the shape of a globular tumor. Under ether narcosis a remaining lobe of placenta was removed and reposition of the fundus made. During the next few days she had some fever but made a good recovery. In order to prevent recurrence of the inversion, a wide-mouth bottle was held in the vagina by means of tampon and perineal binder in such a way that the cervix was in the neck of the bottle.

The authors believe that inversion of moderate degree may at times be overlooked and they emphasize the fact that even careful examination of the placenta may not always guarantee against the retention of a lobe.

R. E. WOBUS.

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